

Biodiversity net gain. Good practice principles for development

Case studies

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Summary

Biodiversity is vital to sustain the UK’s society and economy. Improving biodiversity is integral to sustainable development, and biodiversity net gain (BNG) is an approach to embed and demonstrate this. Working in partnership, CIRIA, CIEEM and IEMA have recently produced good practice guidance on BNG (CIRIA C776a), which builds on the good practice principles issued in 2016.

Given the emergent, but rapidly developing approach to BNG, the project involved extensive consultation with stakeholders. Also, organisations were invited to submit short case studies to illustrate how they are approaching BNG.

The case studies are reproduced in full in this document. Some mention awards or metrics that are relevant to the development described. However, these have not been subject to any form of audit as part of this project and are published as submitted. However, the collection demonstrates the interest and commitment of stakeholders towards achieving BNG.

Table 1 is a summary of the case studies identifying some of the key aspects they cover.

Biodiversity net gain. Good practice principles for development.

Part B: Case studies

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Table 1 Case study summary

Case studies		Engaging stakeholders	Applying the mitigation hierarchy	Designing BNG to deliver Lawton's principles	Contributing to biodiversity priorities	Securing long-term outcomes	BNG activities on site or through offsetting	Securing BNG through a broker or third party	UK-wide legal and policy aims
1	Enhancing biodiversity at Gatwick Airport				✓				✓
2	Ecosystem services valuation, Medmerry scheme	✓					✓		✓
3	2500 homes at land east of Aylesbury (Kingsbrook)	✓	✓		✓				
4	Major road maintenance on the A338 (Bournemouth Spur Road)	✓	✓	✓	✓	✓	✓	✓	
5	Redevelopment at St Leonards Hospital, Dorset	✓	✓	✓	✓	✓		✓	
6	Greater West Programme: Fulscot access road, Didcot					✓			
7	Greater West Programme: Hay Lane, Swindon					✓			
8	Implementing a new EPS licence	✓						✓	✓
9	Biodiversity net positive pilot: Midland Mainline Programme	✓							
10	Biodiversity net positive pilot influences planning	✓							
11	Quarry extension at Gill Mill, Witney, Oxfordshire	✓	✓	✓	✓	✓		✓	
12	Creation of Priest Hill Nature Reserve, Ewell, Surrey	✓		✓	✓	✓	✓	✓	
13	Residential development at Exeter Road, Teignmouth, Devon	✓		✓	✓	✓	✓	✓	✓
14	Protecting cirl bunting at Ashill Nature Reserve, Devon	✓		✓	✓	✓	✓	✓	✓
15	Biodiversity baseline, Transport for London			✓	✓				✓
16	Biodiversity offsetting and GNC pilot, Warwickshire	✓	✓	✓	✓			✓	✓
17	Strategic mapping Solihull, Warwickshire and Coventry	✓		✓	✓			✓	✓
18	Creating new green space at Kidbrooke Village	✓		✓	✓				
19	Working in partnership: creating wetland within London	✓		✓			✓		
20	Beam Parklands habitat creation, Dagenham, London	✓		✓	✓	✓	✓		
21	Bioreceptive built environments, Isle of Wight	✓							
22	Enhancing freshwater habitats, Holbrookes Streams	✓			✓				
23	Zero environmental impact goal, Corriemoillie		✓	✓	✓		✓		
24	Habitat banking process, Tees Estuary Partnership						✓	✓	
25	Identifying land for biodiversity offsets in Paris						✓	✓	
26	Renewables and biodiversity offsets, Scottish Borders Council	✓	✓		✓	✓			✓
27	Living roof enhancement, Bolsover				✓				
28	Enhancing biodiversity on large-scale solar farms		✓						
29	Links to further case studies								

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Abbreviations and acronyms

AVDC	Aylesbury Vale District Council
BAP	Biodiversity Action Plan
BIA	Biodiversity impact assessment
BNG	Biodiversity net gain
BNP	Biodiversity net positive
BREEAM	Building Research Establishment Environmental Assessment Method
EIA	Environmental Impact Assessment
CEH	Centre for Ecology and Hydrology
CIPP	Cured cast-in-place pipe
DCC	Dorset County Council
EDF ER	EDF Energy Renewables
EPS	European Protected Species
FCERM	Flood and Coastal Erosion Risk Management
FCS	Favourable conservation status
GCN	Great Crested Newt
GGP	Gatwick Greenspace Partnership
GI	Green infrastructure
GiGL	Greenspace Information for Greater London
GLA	Greater London Authority
HBA	Habitat biodiversity audit
HMP	Habitat management plan
HRA	Habitats Regulations Assessment
INCA	Industry Nature Conservation Association
IP	Infrastructure projects
ISO	International Organization for Standardization
KPI	Key performance indicator
LBAP	Local Biodiversity Action Plan
LEMP	Landscape and Ecology Management Plan
LEP	Local enterprise partnership
LPA	Local planning authority
NGO	Non-governmental organisations
NHS	National Health Service
NPPF	National Planning Policy Framework
OLE	Overhead line equipment
PFI	Public Finance Initiative
PV	Present value
RSPB	Royal Society for the Protection of Birds
S106	Section 106 of the NERC
SNCI	Site of Nature Conservation Interest
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest
TEP	Tees Estuary Partnership
TfL	Transport for London
WCC	Warwickshire County Council

1 Enhancing biodiversity at Gatwick Airport

Details

Organisations Gatwick Airport Limited
Contact jon.tivey@gatwickairport.com

1.1 PROJECT SUMMARY

Gatwick Airport is the second largest airport in the UK and the world's most efficient single runway.

In 2012, Gatwick Airport Ltd established an initial five-year management plan to maintain and improve biodiversity across two Biodiversity Action Plan (BAP) areas covering 75 hectares of non-operational land.

The BAPs provide a framework for ensuring compliance with the airport's Section 106 legal agreement and Gatwick's sustainability commitments, in addition to maintaining the airport's ISO 14001:2015 certification for environmental management.

Developed in partnership with Gatwick Greenspace Partnership (GGP), part of Sussex Wildlife Trust, the BAPs detail the species and habitat surveys and habitat management actions being taken to improve the biodiversity in the areas of grassland and wetlands.

This is an ongoing project, in its sixth year, with the objective to improve the condition of the main habitats.



Figure 1.1 Nationally scarce long-horned bee on clay environmental slope overlooking the taxiway

1.2 ISSUES

Results show that biodiversity objectives are being met with an increase quality of habitat condition and use of the habitats by protected species. This has included the reduction in invasive species, the return of breeding Great Crested Newts (GCN), and the discovery of the rare solitary long-horned bee (see [Figure 1.1](#)).

One challenge has been improving biodiversity at this major airport while meeting the critical requirements around aerodrome safeguarding, including mitigating the risk of bird strike to aircraft.

Close communication within the airport has been particularly effective, resulting in both safeguarding and biodiversity aims being met.

1.3 OUTCOMES

- Awarded the Wildlife Trusts Biodiversity Benchmark.
- CIRIA BIG Biodiversity Challenge Client Award winner in 2016.
- Gatwick Airport's green spaces are highly valued by local communities and other stakeholders.
- An established biodiversity volunteering programme benefitting both people and wildlife.

2 Ecosystem services valuation, Medmerry scheme

Details

Organisations Atkins, Environment Agency, Natural England, RSPB
Contact Monica.Barker@atkinsglobal.com

2.1 PROJECT SUMMARY

The managed realignment scheme at Medmerry, Sussex, constructed between 2011 and 2013 at a cost of £28m, is the largest of this type of scheme to be undertaken on the open coast in Europe.

As well as protecting homes, businesses and critical infrastructure from flooding and storm events, the scheme has created around 184 hectares of new intertidal habitat, now managed as a Royal Society for the Protection of Birds (RSPB) reserve. Intertidal habitat, including saltmarsh, is generally accepted to deliver a wide range of benefits (commonly known as ecosystem services) to society, including biodiversity, flood defence, recreation, carbon sequestration and provision of nursery habitat for juvenile fish.



Figure 2.1 Intertidal habitat, including saltmarsh, at Medmerry

2.2 ISSUES

The wider benefits of flood schemes are often poorly valued within economic appraisals. Here, valuation refers to an assessment of the importance or significance of a particular service or good. Without an attempt to value such services in monetary terms, the value can be taken as zero. In economic appraisals for Flood and Coastal Erosion Risk Management (FCERM) projects, this means that the effects on natural capital and the associated flows of services can be under-represented, resulting in benefit-cost ratios that do not include the full range of impacts.

The aim of this study was to value the ecosystem service impacts (both positive and negative) of the scheme, to support the ‘mainstreaming’ of ecosystem services and natural capital assessments within FCERM.

2.3 OUTCOMES

The original business case identified the economic benefits of flood protection, estimated as £78.2m in present value (PV) terms over 100 years.

The original business case for the scheme also estimated a PV of £13.5m over 100 years for other environmental benefits. Atkins undertook an in-depth value transfer study of the scheme. This approach estimated the value of ecosystem service impacts of the scheme other than flood protection to be £2.95m per year, with a PV of £89.7m over 100 years. The study demonstrated that the standard business case had significantly underestimated the wider environmental benefits.

Innovative approaches were developed to value the key ecosystem costs and benefits of the scheme. The majority of the benefits relate to existence or non-use values from the provision of new, varied coastal habitats, now managed as an RSPB reserve, which represented a significant biodiversity net gain (BNG) compared to the low-lying farmland that previously characterised the site. The scheme also gave new opportunities for nature-based recreation and tourism. These findings are in-line with other ecosystem service valuation studies, which have indicated that cultural services often provide the largest proportion of benefits.

A concise and accessible report (Environment Agency, 2013), was produced that enables others to replicate and learn from the approaches used.

2.4 KEY BENEFITS AND SUCCESS FACTORS

With increasing pressure on limited flood protection funds at a time when the frequency and intensity of flood events is growing due to climate change, there is a need to prioritise investment. Existing approaches used to undertake an economic appraisal of potential schemes do not typically consider the full range of impacts on ecosystem services and natural capital. To ensure that flood schemes deliver the best value for money, there is a need to adopt new valuation approaches that enable these wider impacts to be accounted for. The ecosystem approach also highlights opportunities to improve the benefits of flood schemes to people, for example, through habitat creation and providing access to sites for recreational and educational purposes.

The study aims to support the Environment Agency in incorporating more sophisticated valuation approaches into cost-benefit analyses and economic appraisals for flood schemes.

Being able to demonstrate the value of habitat creation and management of the Medmerry RSPB reserve will also enable the RSPB to advocate for the creation and protection of similar sites in the future.

3 Development of 2500 homes at land east of Aylesbury

Details

Organisations Barratt Developments PLC, RSPB, Southern Ecological Solutions (SES), BDW Trading Limited, Ashfield Land Ltd

Contact team@ses-eco.co.uk / sustainability@barrattplc.co.uk

3.1 PROJECT SUMMARY

A new urban development combining community and biodiversity enhancements comprising:

- 2450 homes
- 10 hectares of employment land
- a neighbourhood centre
- two primary schools
- construction of the eastern link (part) and the Stocklake link road (rural section)
- green infrastructure (GI)
- associated community facilities.

It will also support infrastructure including an expanded electricity substation and flood defences.

At Kingsbrook, Barratt Developments, the RSPB and SES are working with Aylesbury Vale District Council (AVDC) to set a new benchmark for a commercially-viable housing development that delivers both biodiversity recovery and biodiversity gains. This has been achieved through an ecology-led master planning process in partnership with key stakeholders, contributing to the Kingsbrook development. It is becoming a true ecological exemplar.



Figure 3.1 Kingsbrook, Aylesbury Vale (from HM Government, 2018)

The master plan has been shaped by a suite of surveys that have provided a robust ecology baseline upon which the mitigation hierarchy has been applied. Key GI has been retained and improved with complementary habitats that provide well-connected, ecological networks through the site. Habitat creation includes, but is not limited to, the restoration of arable fields to species-rich lowland meadows, wetland grasslands and the creation of a 100 hectares nature reserve.

Wildlife is being welcomed within the built environment through the adoption of wildlife-sensitive lighting, incorporation of habitat features within the development including the houses, SuDS, gardens, schools and community buildings, through to road verges, roundabouts and extensive green corridors. In addition, there will be community features such as an orchard and allotments, which are biodiversity-rich habitats.

The scheme started with SES undertaking the habitat creation and management works and managing the delivery of biodiversity features within the built environment. Progress on delivery is being recorded and shared with key stakeholders.

The success of Kingsbrook in the long term is dependent of the local community, and SES and the RSPB have been working on community engagement. Communities will be invited to embrace the idea of living and working in a nature-friendly development and to become active participants in green spaces and wildlife conservation projects.



Figure 3.2 Landscape masterplan of Village 2, Oakfield Village

3.2 OUTCOMES

SES was commissioned by Barratt Developments plc to design, plan, and carry out a suite of ecological surveys to inform an Environmental Impact Assessment (EIA) on land east of Aylesbury, a site of more than 300 hectares. Following outline approval, SES has updated the surveys and helped shape and deliver Village 2 (Oakfield Village). Around 60 per cent of Kingsbrook will be GI, including over 100 hectares of accessible, wildlife-rich open space, orchards, hedgehog highways, new ponds, tree-lined avenues, fruit trees in gardens, bat, owl and swift nesting boxes and nectar-rich planting for bees. This achievement was based upon targeted ecological surveys, effective working within a multi-disciplinary team, extensive stakeholder liaison and ecosystem services principles (people and wildlife interwoven for the benefit of both).

The scheme will deliver vital housing in areas where the habitats are of lower ecological value, while retaining and improving those more valuable habitats. Land east of Aylesbury (Kingsbrook) and Village 2 (Oakfield Village) has recently been featured in a document by the UK Green Building Council (UKGBC, 2015) and was highlighted in Defra's 25-year environment plan (HM Government, 2018).

The development includes conservation work for black poplars by planting a number of these iconic trees at the site. The development will eventually be home to the largest black poplar woodland in the country.

New home owners are encouraged to include wildlife-friendly planting in their gardens according to the Barratt Homes (2018) garden guide and can view three wildlife friendly gardens in our show homes to get tips and ideas. To date over 75 innovative integral Swift bricks have been included that were designed in partnership with Action for Swifts, the RSPB, Manthorpe Building Products and Barratt Developments plc to ensure good ecological design and ease, and efficiency of incorporating during building work. The brick is available to the whole sector.

Barratt Developments plc's national partnership with the RSPB is helping to translate the lessons learnt at Kingsbrook across their development portfolio. The garden guide embeds biodiversity into developments, encouraging the planting of high-value plant species that support more wildlife. Kingsbrook will allow new ideas and good practice to be promoted to inspire the UK's housing industry, government and planners to 'give nature a home'.

4 Major road maintenance on the A338 (Bournemouth Spur Road)

Details

Organisations	Dorset Local Nature Partnership, Dorset County Council, Natural England, Hanson, CGO Ecology
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Website	www.dorsetlnp.org.uk/case_studies

4.1 PROJECT SUMMARY

The A338 major maintenance scheme comprised of the complete reconstruction of nine kilometres of the Bournemouth Spur Road.

The scheme required the reconstruction of the failed carriageway, replacement of the central barrier and the renewal of both the drain and culvert systems. The construction area included the carriageway, verge and ditch, including the area behind the ditch as far as the highway boundary fence. The road passes through, and provides linking habitat between several otherwise isolated blocks of lowland heathland.

The project resulted in each carriageway being widened by one metre, leading to a permanent loss of about 0.92 hectares of mown grass verge on land, most of which is used by the legally protected sand lizard and smooth snake.



Figure 4.1 Rare reptile sand patch creation and heathland scrub clearance adjacent to A338

4.2 ISSUES

Earlier work to the carriageway in 2010 included a capture and exclusion exercise and a European Protected Species (EPS) licence. The licence required the installation of seven kilometres of temporary reptile fencing and the capture and relocation of EPS reptiles from the works area. It was estimated that the cost of carrying out a similar licensed capture, rescue and relocation exercise (including installation of reptile fence, hand capture of reptiles from 10 kilometres of verge and preparation of 10 hectares of receptor sites) for the major maintenance scheme would cost around £1m.

“On the face of it this seemed a very extreme approach, but in reality is a very natural way to reduce the adverse impact on the various protected species, while also providing some improved habitat, saving time and money – a great result for all concerned, human and reptile!”

Mike Harries
Head of Environment and Economy, DCC



Figure 4.2 Sand Lizard

In view of the large costs and limited conservation benefits of the 2010 licensed reptile exclusion work, Dorset County Council (DCC) engaged Natural England through its discretionary advice service to seek an alternative approach. The mitigation strategy, developed in partnership with CGO Ecology and DCC natural environment team, provided a means of minimising the risks to individual EPS reptiles, ensuring enhancement of the habitats on which local populations rely, while substantially reducing the cost of the scheme.

Measures included:

- Vegetation clearance carried out in the winter and early spring, when all reptiles were below the ground surface in hibernation.
- Keeping works vehicles off the road verge.
- Removing potential breeding sites during winter.
- Removing potential winter refuge sites during summer period.
- Restoration of heathland within 50 m of the A338 by the removal of trees, scrub, bracken, rhododendron and gaultheria.
- Creation of sand patches to provide additional breeding habitat for sand lizards.
- Creation of habitat piles to provide additional reptile refugia.

“It has been an innovative, cost effective way of working with rare and protected reptiles, avoiding the need for costly fencing and delays, and resulting in many more, far reaching benefits for reptile populations and their special heathland habitat. The close collaboration between Natural England, DCC, CGO Ecology and Hanson has produced a new method of working which we are already using in other development projects; facilitating development while delivering better results for protected species and their habitats.”

James Diamond
Director of Operations, Natural England

4.3 OUTCOMES

- DCC estimate that the new approach saved about £450 000 compared to the previous methodology, representing a 45 per cent saving on the predicted budget.
- No EPS reptiles were reported harmed.
- 30 hectares of heathland was restored, including 17 hectares of pine removal.
- 113 large sand patches were created.
- Habitat piles/reptile refuges were created regularly along 17 kilometres of road verge.
- Stock proof fencing was provided against Ramsdown and Sopley Common, enabling grazing of these Sites of Special Scientific Interest (SSSI) and European heathland sites.
- Prevention of road run off that was causing localised nutrient enrichment to SSSI wet heath.
- Nutrient rich top soil was removed from 16 kilometres of road verge providing a continuous ecological corridor linking key international sites. About seven kilometres of verge adjacent to SSSIs was spread with heather cuttings, the remainder reseeded with a simple grass mix.

- EPS reptile population monitoring before, during and for five years after the road scheme.
- The establishment of sparse heathland/acid grassland habitat on the road verges will substantially reduce the road verge maintenance costs.

4.4 KEY BENEFITS AND SUCCESS FACTORS

The mitigation strategy contributed to the Habitats Regulations Assessment (HRA) of the scheme by enabling a conclusion of no likely significant effects on species typical of the adjacent designated sites. The discretionary advice scheme agreement enabled close collaboration between Natural England, the developer and the main contractor which reduced costs throughout the scheme by ensuring early resolution of issues before they became problematic.

At a time when Habitats Directives are being closely scrutinised this demonstrates a new way of working, which has an undoubted winning outcome.



Figure 4.3 *Spreading heather brash on the new road verge to encourage creation of heathland vegetation*

5 Redevelopment at St Leonards Hospital, Dorset

Details

Organisations Natural England, East Dorset District Council, Homes and Communities Agency, Dorset Wildlife Trust, Sovereign, Johns Associates, Forestry Commission

Contact Nick.squirrel@naturalengland.org.uk / Amarler@dorsetwildlifetrust.org.uk

Website www.dorsetlnp.org.uk/case_studies

5.1 PROJECT SUMMARY

St Leonards was a former hospital built in 1942, used first for military staff and then for civilian patients. It was then taken over by the National Health Service (NHS) in the 1950s. The site was maintained as ranks of single-storey wards linked by concrete paths and covered walkways and with mown grassland between. It also incorporated a cricket pitch, tennis courts and less well-managed areas of pine woodland/scrub and heathland adjoining a Forestry Commission plantation. The site covers 25.9 hectares comprising 7.75 hectares of development site and 18.4 hectares of local wildlife site (called a Site of Nature Conservation Interest [SNCI] in Dorset). The planning application for the development of the site was approved by East Dorset District Council in December 2015.

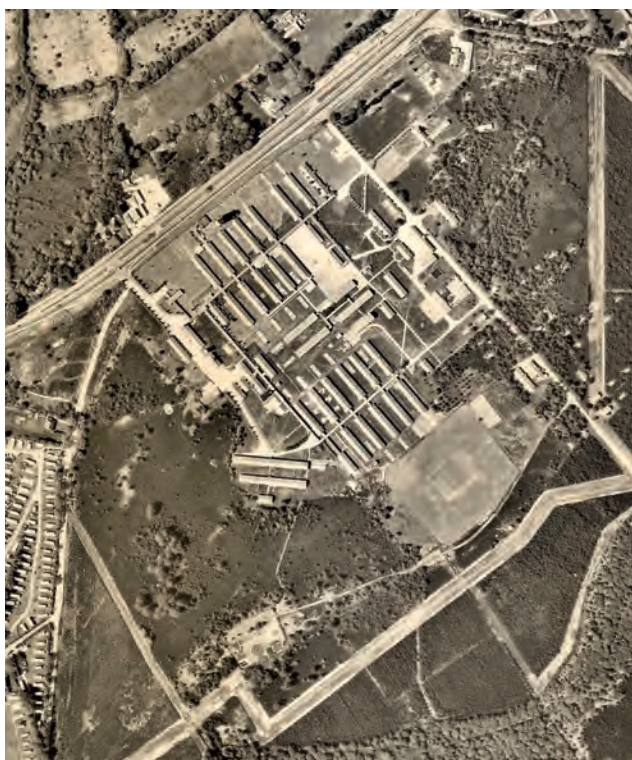


Figure 5.1 Site area

The site was sensitive in terms of its biodiversity, including:

- population of sand lizards (and smooth snakes in the past) with five species of reptile currently present
- priority acid grassland and lowland dry/wet heath habitats
- significant populations of rare/scarce plants (eg green winged orchids, autumn ladies' tresses, mossy stonecrop)
- nightjars from the nearby Dorset Heathlands Special Protection Area (SPA) that use the site
- two maternity bat roosts and roost sites in 16 of the buildings to be demolished on site, with 10 separate species present.

Natural England has advised on the redevelopment of the site for many years, and the resultant planning application protected the on- and off-site biodiversity interest.

5.2 ISSUES

Natural England's advice was reinforced by the firm policy background for this site, which had been worked up with the local planning authority (LPA) within the local plan. This close working, and the

involvement of the Dorset Wildlife Trust, was critical in securing the environmental outcomes. By working with the Forestry Commission a new 25 hectares natural green space, improved for public access and biodiversity, will be delivered. A Landscape and Ecology Management Plan (LEMP) steering group was formed with representatives from Natural England, Sovereign (housing association), Dorset Wildlife Trust, Drew Smith (principal contractor), Johns Associates (ecological consultants), East Dorset District Council, the hospital services Cricket Club and Alaska (translocation specialists). This enabled everyone to have continued involvement in the implementation of the plan, which sets out the ecological objectives for the site along with the mitigation, enhancement and restoration measures and the long-term management of the future SNCI and nature reserve.

5.3 OUTCOMES

- 18 hectares of priority habitat restored to a high standard over seven years.
- Dorset Wildlife Trust will take ownership of the new nature reserve, with grazing in place and a new community on its doorstep to work with.
- Management secured and funded through an agreement for 50 years.
- Key acid grassland/heathland communities in the development site (about two hectares) will be translocated using expert contractors.
- 12 hectares of tree and scrub clearance in the SNCI is authorised through the planning application to avoid the need for a separate felling licence.
- A new bespoke bat maternity roost created from an existing brick building (cost saving) and a substantial number of new bat boxes are to be provided.
- The Forestry Commission will deliver a new 25 hectares site, improved for public access and biodiversity. This will be continually maintained.

This example shows the unique partnership of public and private organisations working together to deliver biodiversity gain through a residential development. It has been highlighted nationally by the Wildlife Trusts as an example of good practice.

6 Greater West Programme: Fulscot access road, Didcot

Details

Organisations	Murphy and Network Rail
Contact	Emmanuel.Deschamps@networkrail.co.uk

6.1 PROJECT SUMMARY

The Fulscot access road project is part of the Greater West Programme and involved the construction of a temporary access road to an existing site compound.

Following completion of the works extensive planting will occur along the new access road, including 261 m of hedgerow comprised completely of woody species, 975 m² of native woodland plants, 335 m² of native shrub and 2632 m² of wildflower seeding. The original landscape design involved grass seeding however, with approval from Network Rail, wildflower seeding will be used instead due to the increased plant species diversity and low maintenance costs.

The biodiversity loss associated with the works was measured using the Network Rail (2017) biodiversity calculator. The works required the removal of 20 metres of hedgerow, and existing grassed groundcover, which resulted in a loss of 1.6 biodiversity units. It is expected the replanting works will provide 3.2 units, giving a BNG of 1.6 units.

It is expected the replanting works will significantly improve the biodiversity on site, as well as provide essential habitat and refuge for several species known to occur in the area including the arable and grassland assemblage farmland birds, corn bunting, grey partridge, lapwing stone curlew and yellow wagtail.

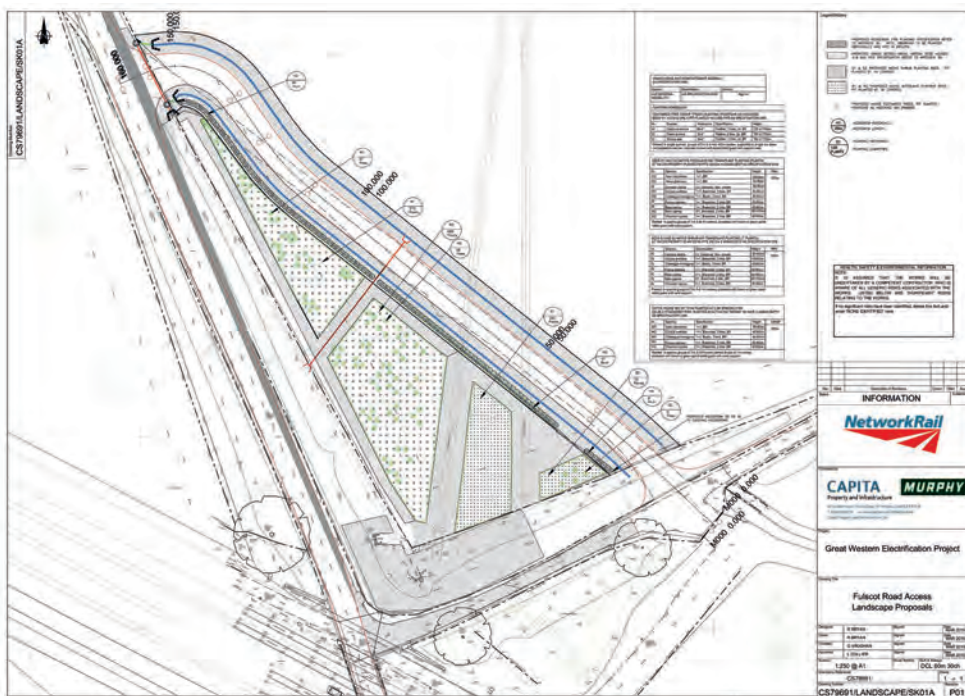


Figure 6.1 Landscape plan for Fulscot access road, Didcot



Figure 6.2 Fulscot Road site, two years after planting of 261 m of hedgerow comprised completely of woody species, 975 m² of native woodland plants, 335 m² of native shrub and 2632 m² of wildflower seeding

7 Greater West Programme: Hay Lane, Swindon

Details

Organisations Murphy, Network Rail

Contact Emmanuel.Deschamps@networkrail.co.uk

7.1 PROJECT SUMMARY

The project involved the removal of the existing railway bridge to enable the overhead line equipment (OLE) to be installed as part of the Greater West Programme and installation of an access road for the local community. Part of the scope was also to improve the drainage systems to alleviate issues with pooling of water in the surrounding area under land drainage consent.

The drainage system was a concrete canvas, which is more sustainable because it contains less embodied carbon and presents no on-site pollution risks as opposed to the use of pre-cast concrete or on-site concrete pouring respectively.

As part of the Great Western Route pilot on 'no net loss in biodiversity' the project team aimed to improve the biodiversity following the installation of a new access road. This was done by engaging with the design partner and subcontract teams over 40 native tree saplings (birch, oak, alder), nearly 1600 native scrub species (field maple, common hazel, common hawthorn, blackthorn, common holly, dog rose) and over 4000 m² of scrub woodland and embankment grass seeding spread.

While the new access road required the part removal of two hedge line, it was previously predominately grassland, with a baseline of 2.3 biodiversity units. The re-planting led to an improved continuous nature corridor, totalling five biodiversity units, and demonstrated a BNG of 2.7 biodiversity units in the area.

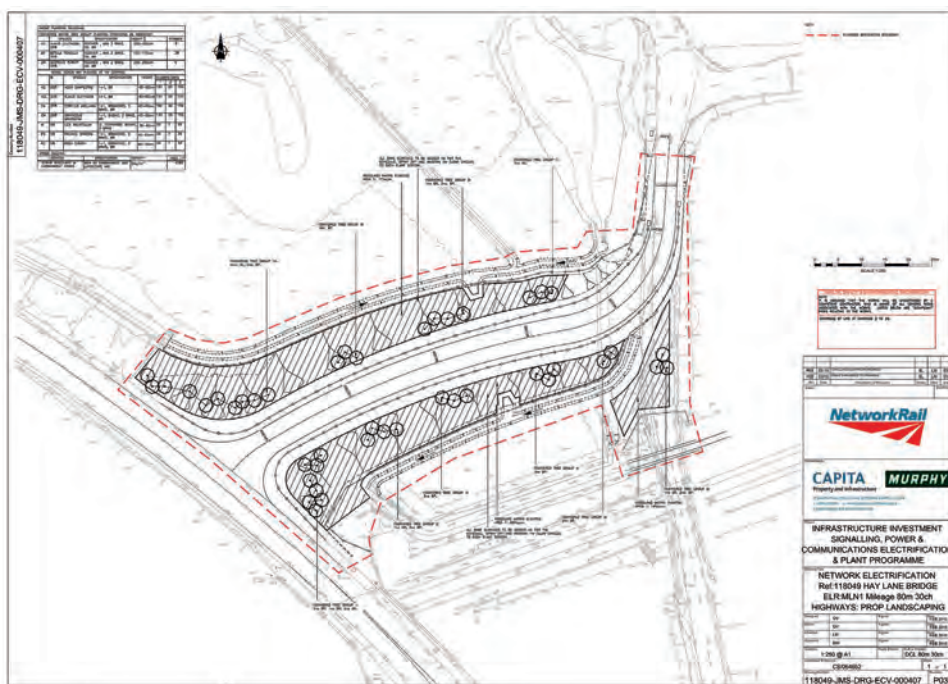


Figure 7.1 Landscape plan for Hay Lane, Swindon

8.4 KEY BENEFITS AND SUCCESS FACTORS

The new licence approach has reduced the need for Carillion to relocate or exclude EPS from the development site, provided that new habitat is created that will improve the local population of GCN.

Carillion Rail in the East Midlands, in collaboration with Network Rail, Atkins Global and Natural England have taken the initiative to lead a strategy to use the new guidance issued by Natural England, securing senior management and legal commitment from Network Rail in the process.

This will:

- achieve a minimum of £500 000 savings as a result of less resources, fencing, trapping, additional surveys etc
- provide programme certainty and flexibility
- have significant positive implications for the wider business – repeating this process for other infrastructure projects will have huge benefits across the industry
- contribute to biodiversity net positive mitigation
- support a guidance document with lessons learned.

9 Biodiversity net positive pilot: Midland Mainline Programme

Details

Organisations	Carillion and Network Rail
Contact	Rachael.Riley@carillionplc.com

9.1 PROJECT SUMMARY

The Midland Mainline Programme's sustainability strategy objective is to achieve biodiversity net positive. Carillion leads the Midland Mainline Programme pilot to deliver Network Rail infrastructure projects (IP) pioneering commitment for a measurable net positive contribution to biodiversity in the UK by 2019.

The Midland Mainline Programme is undertaking significant vegetation clearance to enable the delivery of its improvements, electrification, building and civils projects, resulting in permanent habitat loss. Until recently, no methodology existed to assess this environmental impact and the issues around off-setting have remained controversial, attracting criticism from stakeholders that developers act as though they have a licence to trash. Although there is no legal requirement Carillion recognises the need to address the environmental impact of its works, and supports this pioneering and innovative approach to develop robust tools for the industry.

9.2 ISSUES

Following on from best practice on the Thameslink Programme, Carillion have led on engagement with the Network Rail IP biodiversity net positive (BNP) programme and volunteered the programme as a pilot. The purpose of the pilot is to trial the use of a toolkit that has been developed to assess the biodiversity impact of the works, undertake stakeholder engagement and design mitigation to achieve a net positive contribution to biodiversity.

The toolkit has been developed by the Network Rail IP BNP programme with careful and transparent engagement with stakeholders and 'critical friends' including Defra and Natural England. Other pilot projects include the Greater West electrification programme and East-West Rail.



Figure 9.1 Vegetation clearance for Carillion's Midland Mainline programme projects



Figure 9.2 Stakeholder engagement workshop

9.3 OUTCOMES

Carillion represents the Midland Mainline Programme on the BNP working group. It has published briefings and arranged training sessions, and in February 2016 ran the first engagement workshop with key stakeholders including Natural England, the RSPB, the Environment Agency, The Wildlife Trusts, and representatives from the farming community.

Carillion will use the toolkit to calculate habitat loss and biodiversity units for its current projects. Current estimates for the Kettering to Corby and Bedford to Kettering projects indicate a 30 to 40 per cent reduction in biodiversity because of the works. Carillion is leading on discussions with Network Rail regarding funding arrangements for mitigation.

9.4 KEY BENEFITS AND SUCCESS FACTORS

- Supporting the development of a pioneering and innovative approach.
- Transparent stakeholder engagement.
- Collaborative working with Network Rail and framework contractors.

10 Biodiversity net positive pilot influences planning

Details

Organisations Carillion, Network Rail

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10.1 PROJECT SUMMARY

Carillion's East Midlands rail team continues to lead on the Network Rail BNP pilot, resulting in a planning decision that has saved Network Rail £150 000 to £500 000 in costs.

Carillion's East Midlands rail team introduced the Network Rail BNP pilot to the Midland Mainline Programme and are continuing to lead its implementation. The commitment to the pilot has directly influenced a local authority's determination of the Network Rail EIA screening opinion request for a line speed improvement project at Market Harborough, avoiding potential costs of £150 000 to £500 000.



Figure 10.1 Line speed improvement project new alignment at Market Harborough

The aims were:

- to promote biodiversity through the Midland Mainline Programme sustainability strategy
- no net loss of biodiversity on Network Rail's infrastructure projects
- Key performance indicator (KPI) framework 6.2.2 initiatives and innovation
- KPI framework 6.3.1 number of changes to standards or projects approvals.

10.2 ISSUES

The line speed improvement project at Market Harborough, currently at development stage GRIP3, will involve vegetation clearance and permanent habitat loss. In particular, the project will affect the locally important fauna species, Grass Vetchling, and three potential local wildlife sites that are important due to the presence of fern communities on three overbridges within the footprint of the project. The habitat is also likely to support GNCs, bats, and badgers. The footprint of the project extends beyond the Network Rail boundary and will require planning permission for change of use, which could trigger the Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

10.3 OUTCOMES

Carillion's rail team supported the preparation of the request for an EIA screening opinion, which included a commitment to the adoption of BNP. The team has already started stakeholder engagement regarding the pilot with Natural England, the local authority consultee, and as a result Natural England and the local authority fully understood the concept and determined that EIA was not required.

This was on the understanding that habitat loss would be calculated and mitigated through the adoption of the BNP pilot.

The screening opinion is not enforceable through planning conditions, however it would be invalidated if the pilot was not carried out.

The Network Rail project team had anticipated costs of up to £500 000 to undertake an EIA. This equates to one per cent of the total project budget, which is the industry average.

Carillion's introduction of the pilot to the Midland Mainline has demonstrated innovation and industry benchmarking to achieve cost savings and beneficial stakeholder relationships.

11 Quarry extension at Gill Mill, Witney, Oxfordshire

Details

Organisations	Smith and Sons (Bletchington) Ltd
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11.1 PROJECT SUMMARY

Smith and Sons (Bletchington) Ltd is a family-run minerals company based in Oxfordshire that has several award-winning biodiversity projects to its name.

At its main sand and gravel site of Gill Mill in the Windrush Valley, progressive restoration of worked sites has delivered an impressive wetland nature reserve at Rushy Common, as well as recreational lakes that link to the wider river valley landscape. It recently gained approval for a further major area



Figure 11.1 Quarry extension at Gill Mill, Witney, Oxfordshire

of extraction with progressive restoration planned to deliver one of the most extensive reed beds in southern England, improve public access and construct holiday lodges that will give revenue for ongoing management as well as enjoyment. The current land use is arable, and improved and semi-improved pasture in the river valley.

11.2 ISSUES

The principle of continuing the quarry in the long term initially met with scepticism from the local community in an area that has many former sand and gravel sites. Smiths ultimately won support on the strength of its history of restoration at sites within the current quarried area. It also engaged with the RSPB and other local conservation partners and adjusted its plans.

The projects that Smiths have delivered and plan to deliver show the importance of collaborative working in the design and restoration of sites for biodiversity, including delivery of wider environmental and social benefits. The projects link effectively with the landscape in terms of biodiversity and recreation and access, with designs changed where possible to deliver as many benefits as possible.

11.3 OUTCOMES

The company has recently secured permission for a major 97 hectare, five million tonne extension to Gill Mill. This will enable the site to supply a further five million tonnes of sand and gravel to help meet local

needs over the next 25 years. In doing so, it will protect the future of an existing operation that supports 40 jobs directly and many more indirectly, and which recycles local building waste as aggregates.

The approved restoration scheme has had to reflect various demands, opportunities and constraints, including reducing the risk of bird strike hazard, mitigating flood risk and water management, biodiversity enhancement, and delivering tourism and recreational opportunities.

The scheme includes 61 hectares of reed beds and 66 hectares of other largely priority habitats. Among priority species it will attract bittern, barn owl, water vole, bats and otter. The restored Gill Mill quarry site near Witney will also lead to increased public access to the beautiful countryside. The scheme avoids and protects Ducklington Meads SSSI near to the extraction area, which has cultural importance to the local village due to snakes-head fritillaries, celebrated in the annual fritillary festival.

The plans include lakeside 'eco lodges' to help fund long-term biodiversity management. They will then be powered by a renewable energy plant fed with biomass from the reed beds and woodland. In addition there will be some 11 kilometres of new paths and bridleways. While these will be provided over the long life of the quarry development, in the short term Smiths will also provide new paths along the Windrush Valley linking into their Rushy Common Nature Reserve and the Tar Lakes recreation area. Associated with this Smiths will work with the parish council to provide new parking places in the village for walkers attracted to the new paths.

Once complete, the restoration at Gill Mill will deliver one of the largest connected priority wildlife habitats, including one of the largest reed beds, in southern England.

The scheme won the Mineral Product Association's Biodiversity Award for Planned Restoration in 2015. The judges were particularly impressed by the scale and ambition of the project, and that the design reflects the views of conservation bodies, the local community, the local authority and the Ministry of Defence and will deliver multiple benefits and 'ecosystem services'.

12 Creation of Priest Hill Nature Reserve, Ewell, Surrey

Details

Organisations Surrey Wildlife Trust, Combined Counties Properties and CALA Homes
Contact geraldine.ebenezer@cala.co.uk / mike.waite@surreywt.org.uk

12.1 PROJECT SUMMARY

At Priest Hill, Ewell a new 34 hectare nature reserve has been delivered through planning gain alongside a 1.7 hectare development of 15 residential homes from abandoned playing fields plus some previously-developed land. Before purchase the site had been largely abandoned inviting fly-tipping, arson and other urban fringe problems, while the potential diversity of its habitats (rank semi-improved grassland and scrub) was in decline.



Figure 12.1 Priest Hill nature reserve, Ewell, Surrey

The original developer, Combined Counties Properties, funded much of the priority habitat restoration and creation as well as providing a site manager's house and maintenance base, as a significant BNG. Ownership of the reserve and associated buildings was transferred to Surrey Wildlife Trust ahead of development of the remainder of the site, marketed later by CALA Homes. Throughout the process, the Trust worked closely with the developers and the LPA, Epsom & Ewell Borough Council, to ensure the full potential of the site was realised.

12.2 ISSUES

The site is located within the green belt so there was local resistance to any development, especially the policy-recommended affordable housing allocation (which was subsequently waived). The site has responded well to applied calcareous grassland restoration and creation techniques (green hay propagation/conservation grazing). In addition, the reserve enjoys added security because of the Trust staff being resident on site (S106 of the NERC Act 2006 [conditioned]), which has also supported more efficient ecological monitoring.

12.3 OUTCOMES

Since establishment of the reserve, the Surrey Wildlife Trust has restored or created lowland calcareous grassland, several native species-rich hedgerows and five field ponds. Removal of the hard-standing on

previously-developed areas has allowed for some simulation of arable field margin habitat over chalk. Also, permanent fencing and other infrastructure has enabled the introduction of conservation grazing.

The site presents a new and important ‘stepping stone’ between the Trust’s nearby Howell Hill Nature Reserve and Epsom Downs to the south, assisting re-connection of strategic GI and the wildlife corridor within a biodiversity opportunity/conservation target area. Targeted species conservation management at Priest Hill has benefited from the recovery of S41 of the NERC Act 2006 priority species, eg Small Blue (*Cupido minimus*), White-letter hairstreak (*Satyrus w-album*) and Brown Hairstreak (*Thecla betulae*) butterflies, common lizard, skylark and linnet, as well as several Red Listed vascular plants (Cheffings and Farrells, 2005).

Rapid colonisation of the site by target priority species has accelerated its recommendation for adoption as a new local wildlife site. Access enhancements and interpretative signage have improved visitor experience for local people’s enjoyment of the reserve. CALA Homes funded Trust membership for all initial occupants of the Priest Hill estate, several of which have been continued.

13 Residential development at Exeter Road, Teignmouth, Devon

Details

Organisation Teignbridge District Council, RSPB, EAD Ecology, Hallbaron Ltd
Contacts stephen.carroll@teignbridge.gov.uk / jonny.miller@wsp.com / rossb@eadecology.co.uk

13.1 PROJECT SUMMARY

A 9.5 hectare site on the edge of Teignmouth coastal market town in Devon was allocated in the emerging local plan for residential development. Planning permission was granted a year before adoption.

The policy driver for BNG came from National Planning Policy Framework (NPPF) (CLG, 2012), the [emerging] local plan and other published guidance (Miller and Jennings, 2014). Permission was granted for up to 255 dwellings with all matters reserved except for access.

Development proposals would result in the loss of grassland habitats, with areas of mainly semi-improved and marshy grassland retained and enhanced as public open space. Sustainable drainage systems (SuDS) and play facilities included within areas of primarily improved grassland and the majority of woodland and hedgerows were retained with some strengthened for dormice and bats.



Figure 13.1 Land west of higher Exeter road, Teignmouth, Devon identified for delivering biodiversity net gain

Assessment using Defra metrics identified residual net loss after onsite measures were taken into account. The LPA and third sector partners did not have any offsite compensation schemes at this time. A requirement for a scheme of works was included in the S106 agreement. This was to provide a financial contribution for the LPA to deliver it on their behalf. The size of the contribution was based on

the agreed impact of the development and a calculation of the cost of compensating for a ciril bunting (*Emberiza cirilus*) (a priority bird species of principle importance under S41 of the Natural Environment and Rural Communities Act 2006 [NERC Act 2006]) territory. The LPA deploy such funds into a local compensation scheme for ciril bunting, whereby the RSPB is committed to enhance and maintain habitats to benefit this priority species of principle importance under S41 of the NERC Act 2006. Land has been purchased nearby to establish a habitat bank that can deliver suitable grassland and hedgerow credits, as part of a ciril bunting nature reserve (see [Case study 14](#)).

13.2 ISSUES

The developer wanted biodiversity liability to be expressed financially in the S106 agreement. However, as there was no scheme available at the time, costs were based on a different compensation scheme.

13.3 OUTCOMES

- S106 agreement secured BNG through a financial contribution for LPA delivery.
- Partnership between the LPA and RSPB to deliver compensation as part of a new strategic ciril bunting reserve.
- Assessment using Defra metric encouraged design changes to reduce residual net loss on site.
- Partnership with third sector parties to deliver ongoing BNG.
- Compensation scheme sourced locally that contributes to strategic BNG objectives.
- It is useful to have developed generic costings for offsets delivered by the LPA for inclusion in the S106 agreement (NERC Act 2006).

14 Protecting cirl bunting at Ashill Nature Reserve, Devon

Details

Organisations	RSPB and Teignbridge District Council
Contact	gavin.bloomfield@rspb.org.uk / Mary.Rush@teignbridge.gov.uk / Jonny.Miller@wsp.com
Website	https://tinyurl.com/ycj9ekoh

14.1 PROJECT SUMMARY

Cirl bunting, a priority bird species of principal importance under S41 of the NERC Act 2006, was once widespread and common across southern England, but has now become rare and mostly confined to South Devon. The RSPB has been working with farmers and other stakeholders for 25 years to prevent their extinction and recover their population and conservation status.

The cirl bunting is a highly sedentary species at risk from development of greenfield sites. High pressure of development on these sites has led to a decline in numbers and further development will have a huge impact on the population of the species. The RSPB developed a compensation mechanism with Teignbridge District Council (also now extended to other LPAs) to secure financial contributions for offsite measures in compensation for loss of breeding territories.

Allocations within Teignbridge local plan are anticipated to result in the loss of up to 14 cirl bunting territories. Local planning policies explicitly support mitigation and compensation measures for the species. Guidance by Miller and Jennings (2014) developed during the Defra pilot, identified cirl buntings as a key beneficiary of offsets.

The RSPB identified priority locations for delivering compensation to achieve population scale benefits. Through close working relationships with local farmers the RSPB agreed to purchase land for a cirl bunting reserve. A 37 hectare mixed farmland site near Teignmouth was purchased in August 2017 adding to three hectares of arable purchased in 2015 with previous cirl bunting compensation funds.

A detailed management plan has been agreed for the perpetuity management of the site. This will include managing arable land as low input spring barley, hedgerow restoration and creation, and species-rich grassland restoration.

The national cirl bunting survey 2016 (Croft, 2016) identified eight existing territories onsite. Based on experience following the creation of a cirl bunting nature reserve at Labrador Bay, it is predicted that an additional 14 breeding pairs can be supported on this site through onsite measures. However, receipt of cirl bunting compensation funding requires establishment of these additional breeding territories.

Restoration and creation of habitats for cirl buntings will also deliver a quantifiable uplift in biodiversity unit value. A theoretical compensation scheme is modelled to give predicted values that can be factored into BNG calculations for development sites that affect cirl buntings.

Developments that do not directly affect cirl buntings may require compensation that is consistent with cirl bunting habitat requirements. Such demand may be met by credits generated through this habitat bank. Where this is the case, any cirl bunting breeding territories that arise because of such enhancements are considered incidental and not attributable to other schemes.

14.2 ISSUES

Developer contributions were calculated based on five years of maintenance costs with the RSPB managing ongoing liabilities. Future costs will partly be met by farm tenancies with the remainder from the RSPB.

Individual developer contributions are insufficient to establish a strategic site upfront. However, the RSPB was able to acquire the land. As developer contributions are paid to the LPA, they were transferred to RSPB to reimburse the cost of land and establishment. The RSPB chose to temporarily use internal reserves, pending securing debt finance to cover the purchase cost, so adding capacity to their overall impact for nature. The cost of servicing the debt was in part met from income from leasing the farming tenancy.

There is a risk that insufficient developer contributions will arise or that they will take longer to accrue and so may cost more in debt repayments. Standard S106 agreement clauses allow developers to deliver the compensation on their own or provide the financial contribution. Allocated and approved development may also never appear, or policies change and agreements may be renegotiated. The full extent of anticipated developer contributions may not materialise, but RSPB is willing to accept this risk.

14.3 OUTCOMES

- Positive RSPB partnership with the landowner/farmer for the opportunity to buy the land, and with LPAs to agree and implement a compensation mechanism.
- A 40 hectares habitat bank established in a strategic location to provide credits for development-related impacts on curlew breeding territories or other habitats.

14.4 KEY BENEFITS AND SUCCESS FACTORS

- Free or low-cost capital loans are important to ensure viability in the early stages of establishing a compensation framework. A rolling fund could be established by local enterprise partnerships (LEPs) or equivalent bodies to manage several strategic sites to meet demand.
- In the long term, the cost of delivery should be reflected in development land values reducing the need to rely on public or third sector subsidising ongoing delivery.
- Long-term relationships between the LPA, RSPB and farming community have generated trust and confidence, smoothing project conception, development and delivery.

15 Biodiversity baseline, Transport for London

Details

Organisations	Transport for London, WSP, GiGL
Contact	Kylie.Jones@tfl.gov.uk / Tom.Butterworth@wsp.com

15.1 PROJECT SUMMARY

Transport for London (TfL) is committed to protecting and enhancing its natural assets and has a key target of delivering net gain in biodiversity (ie leaving biodiversity in a better state than how it was found).

The current TfL (2014) framework aims to “*protect, manage and enhance the natural environment within our land holding*” and “*measure and report on the percentage of our land holding with improved habitat and biodiversity quality*”. This is in-line with emerging policies within the draft Mayor of London’s environment strategy (GLA, 2017) and the draft Mayor of London’s transport strategy (GLA, 2018). These documents set out the Mayor’s commitments to reshape London with a focus on delivering the ‘healthy streets’ approach (TfL, 2017) and making London a national park city. Both strategies seek to protect and enhance the natural environment, with the principle of delivering BNG at their core.

Working collaboratively with TfL, WSP undertook an assessment of all habitats within TfL’s business estates (highway, rail and underground) across Greater London and beyond. This assessment provides TfL with an up-to-date baseline of biodiversity across its estate. The baseline used a variety of data sources, including London’s local environmental record centre and Greenspace Information for Greater London (GiGL). However, the data often contained gaps or was too old to use, so innovative methods were employed, such as capturing data using remote sensing to close these gaps. This is the first time remote sensing has been used for a project of this size and at a detailed resolution, providing TfL with a robust dataset. It is now being used on projects across the UK.

15.2 OUTCOMES

This biodiversity baseline enables TfL to strategically monitor changes to biodiversity that result from specific projects and general management practices, by using two (internal) biodiversity toolkits delivered as part of the project, both of which follow the Defra metric for calculating biodiversity units. The first toolkit calculates the biodiversity units for the baseline and enables monitoring at a network level. The second enables TfL to report on biodiversity gains and losses at a project level. Comparing the strategic baseline and these project changes enables TfL to demonstrate the effect it could have on biodiversity at a project and network level across its estate. The toolkits can be split and presented across TfL’s different business areas and by Borough. This enables TfL to track their progress over successive years and communicate the results in a transparent way.

TfL are now systemising the use of both toolkits and are working closely with GiGL who will host and update the biodiversity baseline dataset. TfL and its contractors will then share ecological survey data and reinstatement plans with them. GiGL will update the baseline with new information as it becomes available, ie independently tracking progress against its BNG commitments.



Figure 15.1 Data used to identify habitats

16 Biodiversity offsetting and GNC pilot, Warwickshire

Details

Organisation Warwickshire County Council
Contact davidlowe@warwickshire.gov.uk

16.1 PROJECT SUMMARY

The aim of the project was to maintain and increase quantity and quality of priority habitats with non-transference of habitats lost through development. In addition, using non-priority habitat fails to promote favourable conservation status (FCS) objectives for protected species – initially the GCN.

The GCN is a EPS where a licence is needed for activities that damage their habitat. One of the licensing criteria is that the FCS is not undermined. However, the impact on the overall conservation status is often difficult to show because it requires information about the wider distribution and population in an area. New licensing policies are now in place to also accept compensation further away, focusing on habitat provision for a favourable population and the potential to provide more benefit to newt conservation. However, there is a risk that ‘holes’ will appear in the natural distribution, which needs to be considered in the FCS test.

Warwickshire County Council (WCC) has worked with Natural England to model the sub-region to ‘highlight’ GCN habitat (Maxent) and information necessary to evaluate FCS status at a district/county level. WCC also operates biodiversity offsetting as a mandatory requirement for minor and major developments. In these developments ‘wetland’ habitat is often compensated for through SuDS, leaving no ‘residual loss’ for this habitat type. A sub-regional strategy to safeguard GCNs will need to be able to ‘transfer’ losses from other habitat types.

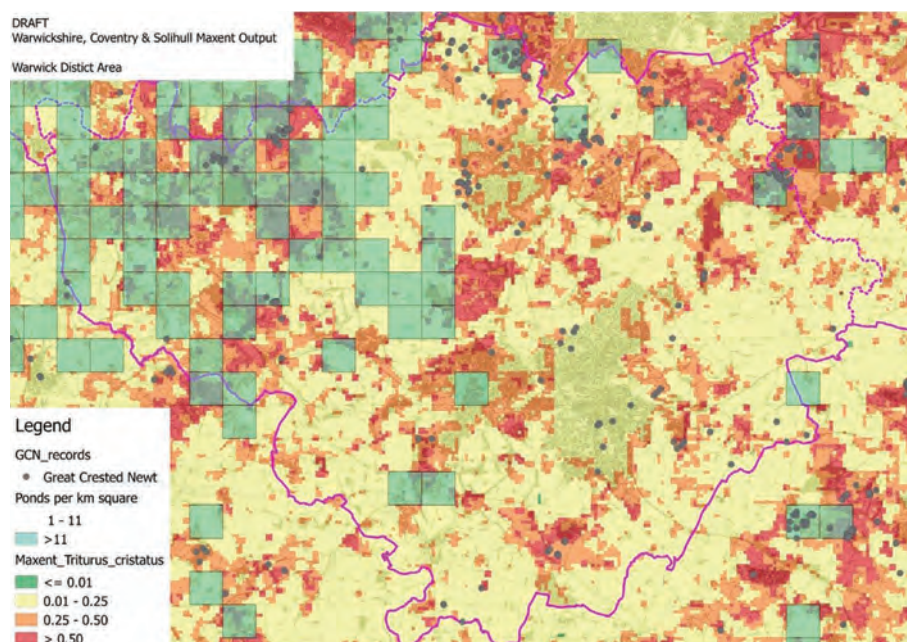


Figure 16.1 Maxent output with pond density thresholds, GCN records, Warwick District

The WCC biodiversity impact assessment classes habitat into 'woodland', 'wetland', 'grassland' and 'other' broad habitat categories, with the 'other' category including arable, tall ruderal and introduced shrub. WCC proposes to use the losses in this 'other' category to fund GCN habitat restoration and creation in Maxent 'red' and 'orange' zones, ie zones where it is expected to support good populations of GCNs. These zones will be monitored to measure ongoing success (or not).

16.2 ISSUES

To do this the following is needed:

- a definition of GCN FCS
- good quality habitat data
- species records
- resources to:
 - model and develop a strategy
 - enact the strategy
 - provide ongoing monitoring.

16.3 OUTCOMES

This approach will ensure that development will continue to compensate for woodland, wetland and grassland habitat losses in strategic enhancement areas as close to the loss as possible. This will help to deliver the greatest benefits and enable some offsetting to wider strategic concerns, such as species conservation. This approach may also reduce the time it takes to reach WCC's FCS objectives. Once FCS has been reached the strategy could then be reviewed.

17 Strategic mapping: Solihull, Warwickshire, Coventry

Details

Organisations Warwickshire County Council, University of York
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17.1 PROJECT SUMMARY

The aim of the sub-regional GI strategy is to fulfil two priorities for each of the woodland, grassland and wetland habitat categories:

- 1 Connect together individual sub-regional GI biodiversity assets to form core areas.
- 2 Connect the core areas together (subject to point 1 being achieved) to form large functional clusters. The Warwickshire, Coventry and Solihull GI strategy (CSWAPO, 2018) identifies sub-regional biodiversity assets that collectively form core areas for woodland, grassland and wetland habitats and the pathways between them. Core areas are 1 km² that contain more than 20 hectares of a suitable habitat category within them. This approach enables Warwickshire County Council (WCC) to identify strategic enhancement areas that have less than 20 hectares of a suitable habitat category within them. This threshold is based on the theory that if a 1 km² which has 20 hectares of a habitat category within it will 'function', ie species will be able to freely move between each GI asset.

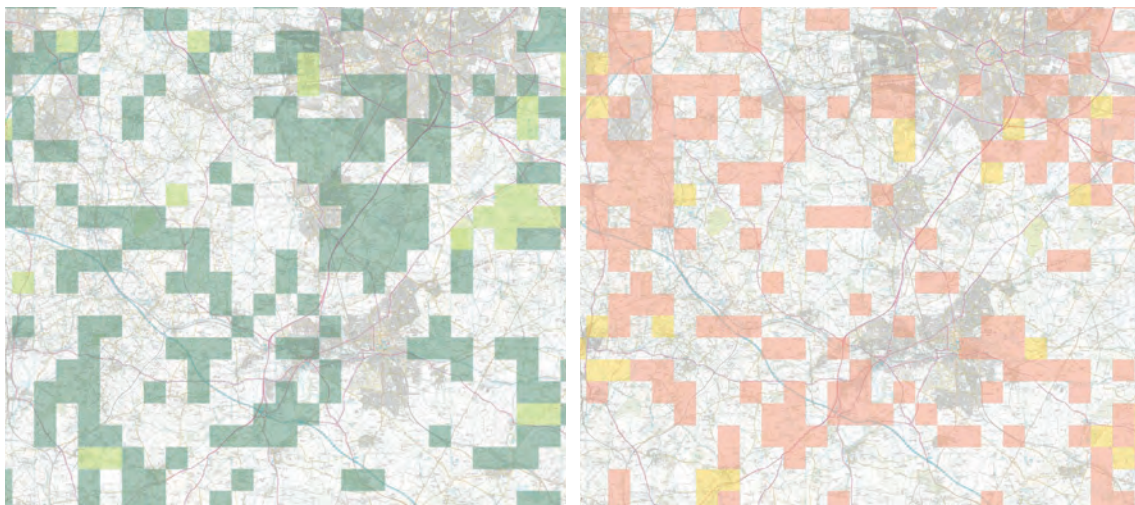


Figure 17.1 Core area and strategic enhancement area

WCC and the University of York used the sub-regional Phase 1 habitat biodiversity audit (HBA) data to identify local connectivity networks at a field and hedge level (Moilanen and Nieminen, 2002). This information is used within planning functions to secure biodiversity connectivity objectives at a site level to meet sub-regional objectives.

However, the WCC needs to know how the sub-region fits into a national picture. To do this they obtained other local record centre plus Landcover 2007 habitat data covering an area from Bristol to The Wash and modelled regional ecological flows (Condatis, Liverpool University). The Council with the Centre for Ecology and Hydrology (CEH), Natural England and Liverpool University have just modelled UK flows (to be published).

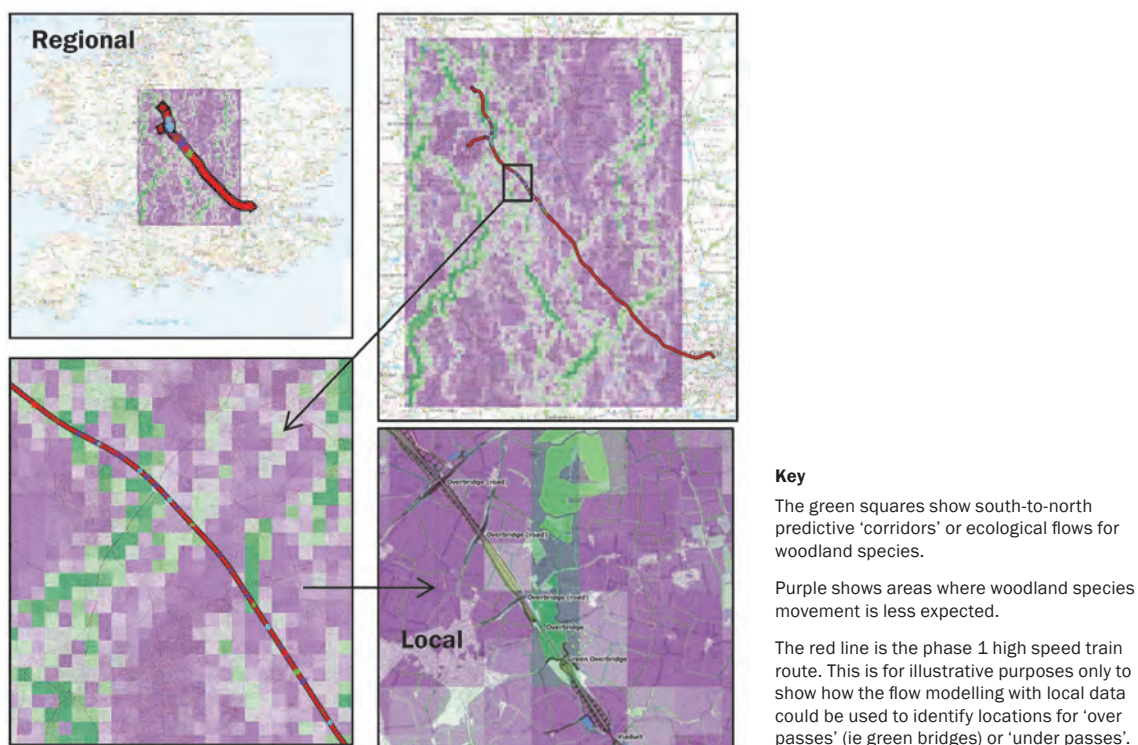


Figure 17.2 Ecological flow maps using HBA and Landcover (2007) data and how they interact with the high speed train route

17.2 OUTCOMES

The strategy can be used by anyone who influences land use and land management at a sub-regional, county, borough, parish, farm, site and field level. So, every decision, however small, could influence national ecological connectivity.

18 Creating new green space at Kidbrooke Village

Details

Organisation	Berkeley Group
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18.1 PROJECT SUMMARY

The Kidbrooke Village development involves the regeneration of what was the Ferrier Estate in south-east London into a vibrant new village community with 35 hectares of green parkland as the centrepiece.

The development is a long-term regeneration project that began in 2009 and has delivered 1450 homes to date. Re-connecting people to the wildlife on their doorstep is an important part of the regeneration of an area. To connect local residents with the wildlife on their doorstep, Berkeley partnered with the London Wildlife Trust to deliver a programme of free community events called 'Wild about Kidbrooke Village'. This is part of a wider project looking for opportunities to enhance the ecological value of the green spaces within the Kidbrooke Village development and encourage the local community to become an active stakeholder in their long-term use and management. Activities included craft events, nature talks, pond dipping, mini beast hunts, mammal surveys and a trip to Woodbury Wetlands in North London, as well as workshops at local schools. Working with the Trust and on consulting with The Royal Borough of Greenwich's BAP, a plan to provide green space that engaged the local community and increase biodiversity and sustainability was formulated.

18.2 ISSUES

A resident survey by the Trust suggested that people mostly walked through the Parks but did not normally spend time in them. Feedback has shown that Kidbrooke Village residents highly value their greenspace (45 per cent say that nature and wildlife is what they value most about living there), and the events help residents better understand the value of the biodiversity around them. The main lesson learnt was that organising the events during the autumn and winter months significantly limited the type of activities that could be undertaken and variety of wildlife that could be seen. Berkeley's intention is to continue the community engagement with further activities during the warmer months.

18.3 OUTCOMES

Various ecological features have been included in the development to date, including an extensive parkland area with integrated lakes, swales and planting, as well as brown roofs on the buildings. It was decided that the park would be an ideal location to consider increasing the biodiversity of the site. The Royal Borough of Greenwich's BAP was consulted to see what could be done and Berkeley collaborated with the Trust to obtain specialist advice. The Black Poplar was listed in the BAP as a species that the council was working hard to reintroduce into the area to battle a growing decrease in numbers. Being Britain's rarest native timber tree with over 100 specialist insects associated with it including moths, bees and butterflies, the team felt this would be great to incorporate into the new park. Typically, they flourish alongside streams and rivers so it was decided to plant the trees near the swale, which is part of the wider SuDs design across the development. Berkeley, the Trust and pupils from a local primary school teamed up to plant a new avenue of these trees.

19 Working in partnership: creating wetland in London

Details

Organisation	Berkeley Group
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19.1 PROJECT SUMMARY

As part of the estate regeneration programme at Woodberry Down, Berkeley has worked with the London Wildlife Trust to restore an 11 hectare wetland.

Restoration work began in 2010 and today it is home to 13 000 m² of newly-planted reed bed and 550 m² of new hedgerow, as well as wildflower meadows and fruit trees, which combine to create a haven for birds, bees, butterflies and other insects. The wetlands are unique as they are tranquil space within London. They provide the local community access to open space and wildlife



Figure 19.1 Local community enjoying the nature reserve

along with other benefits including helping to reduce the urban heat island and managing flood risk. The nature reserve is now a thriving habitat for migratory birds and is one of the Trust's top visitor attractions. The reserve was opened by Sir David Attenborough on 21 April 2016 and within the first five days had been visited by 4500 people. Engaging with local communities and encouraging volunteers to be actively involved in designing and maintenance was an important part of this project.

19.2 ISSUES

Managing all the different partners in this project set a precedent for projects of this type. The partnership between the London Wildlife Trust, Thames Water and Berkeley Group was a unique opportunity to engage and gather expertise from a range of organisations, all of which required complex project management skills.

19.3 OUTCOMES

The area now consists of 13 000 m² of newly-planted reed beds and 550 m² of new hedgerow alongside wildflower meadows and fruit trees. The nature reserve is now thriving and is good habitat for a range of species including birds, bees, butterflies and other insects. Migratory birds are a key success to this project and they are one of the Trust's top visitor attractions.

20 Beam Parklands habitat creation, Dagenham, London

Details

Organisation Environment Agency, The Land Trust, Arup

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20.1 PROJECT SUMMARY

Following extensive ecological assessments, the project safeguarded the habitats identified as most valuable. Construction works were carried out with consideration for protected species including GCN, water vole, reptiles, and Schedule 1 (The Conservation of Habitats and Species Regulations 2017) breeding birds (Wildlife and Countryside Act 1981). The project also integrated new, nationally-important UK BAP habitats within the existing ecological diversity of the site, and improved habitats for these protected species. These included reed beds, wet woodland and lowland fen, 10 000 trees and shrubs were also planted, which increased the connectivity with important areas beyond the boundary. The work formed a crucial element of London's 'green grid' (GLA, 2012). Natural play elements were designed into the project to encourage interactions between people of all ages and the natural environment.

The primary aim was for the redesign of the park to give a higher standard flood storage capacity to protect downstream assets. This would provide an improved community facility to contribute towards the regeneration of the area.



Figure 20.1 New wetland habitat with volunteers tending it

20.2 ISSUES

- The project has resulted in the creation of extensive reed beds along the Wantz Stream. However, the structures chosen to assist in the establishment of reed beds along the Beam River have largely been ineffective. To ensure more successful establishment, reed bed structures should be chosen to withstand the strongest and highest levels of flow, and located strategically where there is the greatest chance of establishing reed beds.
- The wet woodland on site has successfully established along the Wantz Stream, but has yet to establish next to the Beam River. Instead of extensive planting, the project team decided to create the physical conditions in which natural succession into wet woodland would occur. This was most successful where located next to existing wet woodland along the Wantz Stream. It has not yet resulted in success along the Beam River where there is little existing wet woodland. This evidence suggests that when wet woodland is a key habitat objective, proposed creation areas should be planted directly with wet woodland species, to give the best chance of successful establishment.
- While woodland planting across site has been successful, some orchard areas have not developed as intended.
- The project team decided that chemical treatment would not be used on site, either to treat invasive species or to remove aggressive grassland species from the topsoil. Japanese knotweed was effectively removed from site using mechanical methods, however *Crassula helmsii* and Himalayan balsam were not successfully eradicated and, in some locations, wildflower and lowland fen seeding has returned to rank grassland.

20.3 OUTCOMES

The focus of the works was on replacing low value habitats, such as amenity grassland, species-poor long and rough grassland areas, and extensive patches of bramble and nettle, with the higher value priority BAP habitats (wildflower meadow, wet woodland, lowland fen, reed beds and ponds). In most cases, the more valuable semi-natural habitat types were replaced by other priority or higher value habitats to ensure BNG. Such losses were restricted where possible and the replacement habitats were of at least equal ecological value overall.

The area of woodland habitat on site more than trebled, with woodland primarily replacing long grassland or amenity grassland. Also, there was an increase in the area of wetland habitats on site, with ponds also primarily replacing species-poor long grassland (including restricted areas of acid grassland).

About 600 m of the River Beam channel was subject to re-profiling works, and 180 m of the Wantz Stream and stands of invasive species have either been removed or are under treatment plans.

Some 200 m of new hedgerows have been planted on site and habitats were created for an additional seven species of bird in 2015 to 2016. This, when compared to the baseline in 2009 and the number of individual species such as reed, sedge and Cetti's warbler, was higher than was recorded at the baseline stage, and suggests a gradual increase in populations of those species on site.

Evidence of water vole was found in 2015 within the recently re-profiled area of the Wantz Stream and a DNA sampling in 2016 confirmed that GCNs had expanded in range from the eastern side of site to the new pond furthest west on site.

21 Bioreceptive built environments, Isle of Wight

Details

Organisation	Artecology, Ventnor Botanic Gardens
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21.1 PROJECT SUMMARY

Artecology has worked with clients on the Isle of Wight, using different mixes of ‘anthropic stone’ construction and render, to create naturalistic and ecologically-designed surfaces in the public realm. These small interventions have created a cluster of novel built environments. Work was undertaken for Ventnor Botanic Gardens, Isle of Wight Council and the Highways Public Finance Initiative (PFI), to extend some of these installations between 2016 and 2017, prompted by the success of these features as both sculpture/ornament, and biologically ‘activated’ urban spaces. The combination of structural and hard landscape functionality with increased ecological value and enriched public experience (including educational use) has made the concept of high-performance, biologically-favourable textured renders, for repairs and for new construction alike, which is an attractive alternative to conventional approaches.

The aim in both these cases are the ongoing need for structural repairs to build public infrastructure combined with an interest in trialling methods for ecological gain for public policy compliance and organisational commitments to sustainability. The sculpted renders are made from natural cement (Vicat Prompt) with high paper content. This offers cost-savings in rapid cure times and minimal pre-fabrication. It also adds ecological value because of the responsiveness of the material to sculpted and constructed habitat features, including breeding, basking, foraging and overwintering niches for invertebrates, small mammals and reptiles, and surfaces favouring colonisation by plants.



Figure 21.1 Outcome of the works

21.2 ISSUES

The simple and low-cost nature of the small habitat works makes them practically appealing, causing minimal disruption to the sites or delay to wider operations. However, the need to overcome objections (administrative, contractual, legal, reputation) to using unconventional techniques has been more challenging. Using opportunities to deploy these methods as demonstrations in small retrofits and repairs has been important in building a platform from which to be more persuasive and convincing.

21.3 OUTCOMES

Small urban habitats, delivered through textured renders and anthropic stone, provide simple and effective interventions in urban built environments, suitable for new construction and ideal for retrofits and repairs. The public realm work on the Isle of Wight has delivered increased wildlife activity (reptiles, ground and wall-nesting invertebrates, pollinators). The 'patchwork' approach to repairing built environments with biologically-receptive surfaces, textures and designed renders, increases the possibility of planning for cumulative ecological gains on sites via their maintenance schedules and budgets.

22 Enhancing freshwater habitats, Holbrookes Streams

Details

Organisation Artecology, Arc Consulting, Island Roads
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22.1 PROJECT SUMMARY

This project aimed to mitigate the effects of profile changes to a culvert following the installation of a UV-cured liner (in particular, the step into the new culvert lining) by providing a continuously accessible passage for fish (eels as a priority) and other freshwater fauna.

To upgrade a road culvert, carrying the Holbrookes Stream under the A3054 on the Isle of Wight, Island Roads (Highways PFI) commissioned the installation of a UV cured cast-in-place pipe (CIPP) liner. The scheme required ecological assessment for the local authority and an environmental permit application to the Environment Agency. As a result, mitigation for changes to the profile of the culvert (a raised step from the spillway) was recommended, responding to the potential for additional obstruction to fish passage.

Consulting ecologists Arc worked with the Environment Agency and Island Roads to address this issue, but also to extend the reach of this work to solve an additional, existing problem of connectivity – the large drop from the spillway to the downstream channel. In this way, a compliance and mitigation project became an ecological gain project and collaboration between the regulator, the contractor and the advisory team.



Figure 22.1 Elevator pavement with dimpled backwater section for plant colonisation



Figure 22.2 Newly laid tiles showing the double pattern

The resulting 'Elevator', designed by Artecology, comprises a modular tile system, retrofitted easily into the existing concrete channel with an additional steel ramp, installed and connected so that the tile pavement runs seamlessly from the stream bed to the top of the culvert. It provides a combined solution to the culvert lip and the spillway drop, meeting the objective of providing a continuously accessible passage for fish (eels as a priority) and other freshwater fauna.

22.2 ISSUES

This project began as a standard compliance exercise, but quickly became a partnership between regulator, contractor and advisers, collaborating for ecological gain. The construction of the tile array became a collective effort, with staff from each organisation working together to finish the installation. In this way, the process of ecological appraisal, mitigation strategy, enhancement design and construction method created a new relationship and shared objective between regulator and contractor. Another result has been a willingness among all the partners to consider new and unconventional approaches to ecological gains in engineering and infrastructure projects.

An important lesson was that the institutional and bureaucratic barriers to new thinking, required to deliver BNG in urban environments, can be broken down when all parties collaborate around a shared task of ecological design.

22.3 OUTCOMES

The project has delivered a permanent enhancement of ecological connectivity and *in situ* habitat quality within the built environment of the river channel and its road culvert. The complexity of the existing and repaired concrete surfaces has been significantly increased, creating new and varied micro-habitats as well as the physical connector for wildlife passage across a previously-obstructed stream reach.

The project was awarded a special commendation at the CIRIA Big Biodiversity Awards 2017.

Following the success of the Elevator project, the use of ecologically-designed surfaces for biologically-favourable repairs and retrofit enhancements, has become a mainstream consideration for the Highways PFI engineering team.



Figure 22.3 The channel beginning to green



Figure 22.4 Eel pass greening

23 Zero environmental impact goal, Corriemoillie

Details

Organisation EDF Energy Renewables
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23.1 PROJECT SUMMARY

The project aim was to help EDF Energy deliver its net zero environmental impact goal by providing affordable low carbon to customers while having a net positive environmental impact. The goals were to manage habitat and species including:

- blanket bog, dry heath, alpine and boreal heaths
- breeding population of red-throated divers
- otters, bats, water vole, wild cat and pine marten.

The development team at EDF Energy Renewables (EDF ER) quickly established that the key long-term objective was to create the conditions that will enable the expansion and/or restoration of blanket mire.

The Corriemoillie Wind Farm site (and the wider Corriemoillie Estate) is located seven kilometres north-west of Garve in the Scottish Highlands and is being developed by EDF ER, which is a 50:50 joint venture between EDF Energy and EDF Énergies Nouvelles. The wind farm construction started in 2015 and the site became operational in December 2016. It consists of 19 turbines with a generating capacity of up to 60.8MW. The project is wholly owned and operated by EDF ER.



Figure 23.1 Restoration works (before)

The development was given approval providing an approved habitat management plan (HMP) was in place to protect and manage habitats and species within the site. The scheme was specifically required to consider:

- managing/restoring blanket bog, dry heath, alpine and boreal heaths

- opportunities to enhance the breeding population of throated divers on the Corriemoillie Estate
- the interests of otters, bats, water vole, wild cat and pine marten.

A targeted blanket mire restoration area was established over an area of 50 hectares around blanket mire core area, with the removal of 31 hectares of failed and later felled woodland and 0.8 hectares of open water. The felled areas were commercially afforested with Sitka spruce and lodgepole pine, planted in a system of ploughed ridges and furrows. Trees were mostly felled in 2013, and brash removed between 2015 and 2017. An area of about 0.5 hectares of woodland remains standing, within the restoration area.

In February 2017, field survey visits were completed and a plan for the restoration of the blanket bog was developed by specialist contractors Nevis Environmental and Highland Conservation Ltd. The plan also highlighted other constraints that needed to be avoided during the restoration works on site such as breeding birds, water voles, and dwarf birch (*Betula nana*). Highland Conservation carried out the restoration work (ie ditch blocking with dams, turf covered peat cuts, hag re-profiling) in each area.

Re-vegetating and re-profiling of eroded hags and gullies were identified as one of the main methods suitable to improve the condition of the blanket mire areas within the restoration area. This technique had not been previously mentioned in the HMP or specified in the bog restoration assessment report. This work mainly involved the stabilisation of the eroded banks using a combination of re-profiling the degree of slope to under 40 degrees and using on-site vegetation gained during this process. The methods used for peat bunds also apply as there was a need for a comprehensive approach with many of the restoration sites being suitable for both blocking the flow of water by creation of peat bunds and re-profiling of steep and eroding sides. Re-profiling works ensured that sufficient vegetation next to hags and gullies was available for re-turfing, without compromising the habitat that turves were taken from.

Restoration works started at the end of July with three specialist excavators operating on site. Works were completed by the end of August. During the works, the southern boundary of the mire restoration area was modified to increase the overall restoration area to over 55 hectares. A minimum of 778 peat bunds were created in the restoration area. Hag re-profiling was completed along at least 8400 m of gullies in both the mire habitats and afforested areas.

The bog restoration was completed in 2017, but ongoing surveys will be required to monitor how the vegetation and habitat communities change over time because of increasing water tables. This is a slow process and levels of change will only become apparent in the long term, however early signs are positive.

For the rare red-throated divers two key mitigation measures were proposed at the planning stage of the wind farm to enable divers to breed successfully. A 500 m corridor was designed into the wind farm layout to enable movement access the identified breeding loch via their preferred flyway route and minimise collision risk. In addition, a stand of conifers was retained around the breeding loch and to minimise the visual disturbance of the birds by activities on site. To encourage further breeding pairs to the site diver rafts have been scheduled for construction and will be placed on site in a suitable location before breeding pairs returning to the site to prospect for nests.

23.2 ISSUES

During the construction phase of the wind farm, the main contractors store peat as they would with many soils. This causes significant problems when trying to undertake restoration works because of mineral contamination or the drying of the peat.

In the first year of operation an exposed slope above the site experienced a land-slip during heavy rain and flash flooding. The damage required the slope to be stabilised and damage to cable trenches to be repaired. However, this incident demonstrated the value of restoring peat bog in the area.

Restoration works usually take place after the main construction of the project and supporting infrastructure has been done. An optimal solution may be to carry out restoration work when roads, crane



Figure 23.2 The use of peat dams to aid water retention to re-wet the blanket bog (after)

pads and turbine bases are being constructed. This means that peat storage and transport of peat on site is minimised and can be used to deliver restoration of the blanket bog before vegetation and peat degrade.

During construction a protection zone was set up to ensure no site workers approached the nest during activities. In the operational phase all workers were advised of the presence of a sensitive and rare bird species breeding on site. They were also informed to stop and leave their vehicles at turbines and the substation to reduce accidental disturbance.

23.3 OUTCOMES

- 55 hectares of peat bog have been restored.
- Reversing the actively drained peat should save 49 tonnes CO₂eq per year.
- Slowing or preventing the active erosion of peat should save a further 31.5 tonnes of CO₂eq per year.
- The peat bog will provide enhanced flood attenuation for communities' down-stream of the project.
- The peat bog is an internationally-threatened habitat and this work should ensure its continued protection, and for the species that depend upon it.
- The wind farm provides an income for the local community that may otherwise consider a blanket bog uneconomical to manage.
- The blanket mire restoration project supported the employment of specialist local contractors, which helped the local economy and a more reliable and committed workforce.
- The approaches used have avoided the need to transport peat around or offsite.
- The northern section of the reinstated habitats at the base of one turbine was chosen as an area to demonstrate high-level reinstatement.
- The red-throated divers have bred successfully during both construction in 2016 and the first year of operation in 2017, fledging three chicks over these two years. This is an excellent success rate and exceeds the national average of less than one chick per year.
- EDF ER have developed a project that has resulted in a BNG for the local community, while using the lessons learnt to improve the outcomes on further projects.

24 Habitat banking process, Tees Estuary Partnership

Details

Organisation	Tees Estuary Partnership
Contact	Robert Woods robert.woods@inca.uk.com

24.1 PROJECT SUMMARY

The Tees estuary is highly industrialised and space-constrained, where commercial activity co-exists with internationally-important wildlife habitats. For many years stakeholders in the estuary have worked together to improve the overall environmental standards on the river and its hinterland and are proud to boast a thriving seal colony, major bird habitats and one of the best wetland nature reserves in the country. In addition, many of the major companies operating in the area actively engage in BAPs on their sites, supported by the Industry Nature Conservation Association (INCA), a membership organisation comprised of industry, regulators, local authorities and conservation non-governmental organisations (NGOs).

Against this background, Natural England announced a review of the Teesmouth Cleveland Coast SPA boundaries in 2015. To overcome considerable concern raised by industry, a bold approach was embarked upon aiming to extend the level of co-operation already existing to create a genuine partnership to embody the interests of all stakeholders. This group, the Tees Estuary Partnership (TEP) formed early in 2016 and comprises representatives from key industries, the regulators, local authorities and conservation NGOs and is facilitated by INCA. The TEP aims to support the needs of industry and wildlife beyond the SPA review.

24.2 OUTCOMES

As part of its strategy towards meeting the needs of nature conservation, the TEP began development of a habitat banking process for the Tees in summer 2017. In developing this process the initial aim was to learn from experiences elsewhere, but the complexity of the needs of nature conservation and industry would mean that a bespoke solution was required.

The Tees habitat banking system will provide a strategic approach to land availability to meet the mitigation needs of developers in the estuary, leading to a simple and clear planning process. The developers will be able to purchase biodiversity credits in the form of habitat creation/enhancement to offset the debit from the environmental damage caused by development. Landowners will also be able to 'feed' land into the process, while retaining ownership of it, to gain credits from other developers who wish to pay for land management as part of their own mitigation needs. The approach will be rigorous and underpinned by legal agreements.

There will be significant and exciting benefits for wildlife as the strategic approach. This will lead to a network of sites that aim to retain high quality existing habitat, and both enhance and create a range of important habitats, particularly for water birds, but also in support of a multitude of non-avian species. In-roads have already been made in developing the structure and governance of the habitat banking process and definition of the biodiversity metrics system (Defra 2012), which will support the whole process, is being progressed. It is hoped that 2018 will see many new opportunities opening up as design of the process gathers pace.

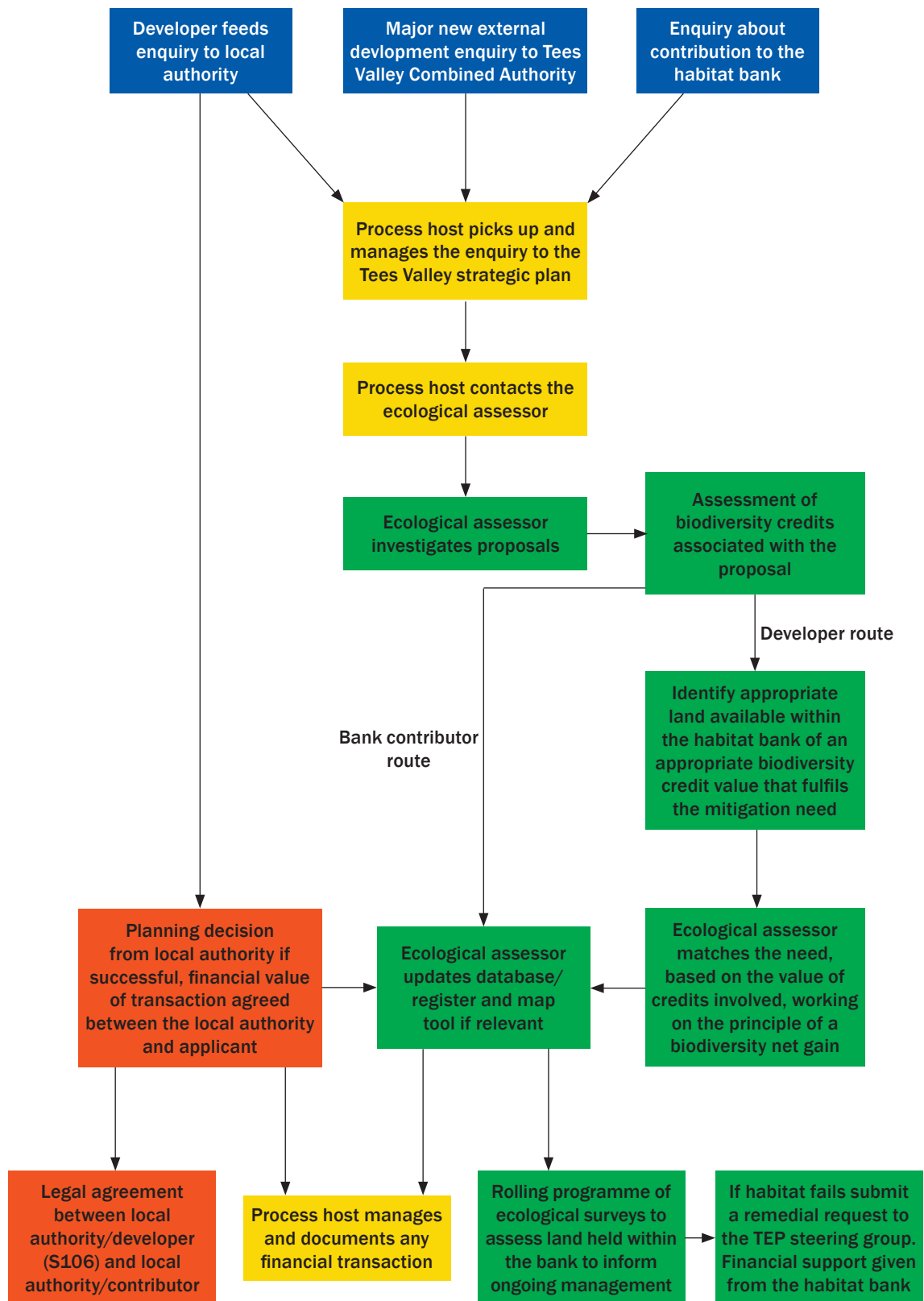


Figure 24.1 Proposed habitat banking process

25 Identifying land for biodiversity offsets in Paris

Details

Organisation ARCHIPEL
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25.1 PROJECT SUMMARY

ARCHIPEL is a new offset provider for the Paris Metropolitan area, established since November 2016 as a partnership between SAFER Ile-de-France (the main real estate operator for agricultural and natural land) and BIOTOPE, the leading ecological engineering firm in France. A joint venture was established in January 2018.

The goal of ARCHIPEL is to assist developers and local governments in applying the recently strengthened no net loss policy in France, and in particular by designing offsets that benefit farmers and local communities as well as biodiversity. To this end, ARCHIPEL provides a unique combination of leading ecological expertise and land management tools, fully embedded within local communities. In its first year of operation, ARCHIPEL has already been mandated to find 100 hectares for offsets, and demand is expected to grow strongly.



Figure 25.1 Offset compensation area

SAFER are private non-profit companies with public interest missions that operate under the control of the Ministry of Agriculture and the Ministry of Finance. Each year, SAFER purchase about 94 000 hectares (about 17 per cent) of rural land transacted in France. 90 per cent of the sales are friendly acquisitions, but SAFER may also use a first right of refusal, as they are informed of every intention to sell agricultural and natural land (about 6000 per year for the Paris area). There is one SAFER per administrative region in France.

In their transactions, SAFER guarantee that land remains under agricultural or conservation use for up to 30 years with a binding set of land management requirements.

SAFER conduct daily monitoring of all land sales and holds a constantly updated database of available land for offset programs. They operate through multi-partner technical committees in each French department, which examine all applications to purchase rural land, and give technical advice on the applicant's project for the land. In Paris, the committees bring together farmers' unions, local governments, the French State and at least two conservation NGOs. This provides SAFER with frequent contacts with local communities and a robust process to:

- assess the feasibility and acceptability of proposed offsets
- identify land for offsets
- call on potential offset providers, ie applicants seeking land for restoration or conservation (who can be farmers, foresters, environmental NGOs, public agencies etc).

Compliance with offset management plans is enforced through SAFER's contractual rules when selling land. Also, when buying land from the SAFER, an offset provider benefits from a tax relief. In the event of non-compliance with the offset management plan, tax relief must be paid back. BIOTOPE provides the necessary expertise for preparing these management plans, overseeing implementation, and/or monitoring compliance. Management plans must meet the requirements of developers seeking to offset their impacts on biodiversity, and of the prospective land managers (offset providers). To this end, BIOTOPE defines metrics and 'credits', identifies suitable land through baseline studies, designs action plans and prepares business models (financial planning).

BIOTOPE and the SAFER are working towards expanding this model to other French regions and abroad.



Figure 25.2 *Bitten in among the reeds*

26 Renewables and biodiversity offsets, Scottish Borders Council

Details

Organisation	Scottish Borders Council
Project partners	Scottish Agricultural College, Scottish Borders Council, Borders Forest Trust, Southern Uplands Partnership, Tweed Forum, the Game and Wildlife Conservation Trust, the RSPB, East Lothian Council, RES, Scottish & Southern Energy, Scottish Power Renewables, Fred Olsen Renewables/Natural Power, Cemex, Infinis EDF and NTR
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26.1 PROJECT SUMMARY

The Scottish Borders contain a wide variety of biodiversity assets of international, national and local value. The area has seen a significant amount of renewable energy development, particularly wind energy. National and local planning policy is supportive of renewable energy development, while also seeking to minimise adverse effects on wildlife.

Scottish Borders Council's local development plan requires that wind farm developers demonstrate that they have considered options for minimising impacts, including options for locating the wind farm in relation to the biodiversity interest of the site and surrounding area. However, for locally-important biodiversity, local development plan policy allows that the reasons in favour of development may sometimes outweigh the desirability of retaining particular habitat features on a development site. Where this is demonstrated, the Council's policy seeks local compensation measures aimed at ensuring no net loss of Local Biodiversity Action Plan (LBAP) habitats, including the creation of new habitats or the enhancement of existing habitats to deliver multiple benefits adopting an ecosystem approach.



Figure 26.1 Scottish Borders

26.2 OUTCOMES

The Council and stakeholders have developed a biodiversity offset scheme that accounts for the residual environmental impacts of renewable energy on black grouse, blanket bog and other upland habitats, and to compensate for loss of woodland in accordance with the Scottish Government's policy (Forestry

Commission, 2009). The implementation of 11 schemes has ‘mainstreamed’ biodiversity into the planning process by seeking biodiversity benefits at the landscape scale, while simultaneously benefiting ecosystem services. These include flood protection (riparian woodland, wetlands and bog habitats), water quality (siltation, diffuse pollution), carbon storage (woodland, grassland and bog habitats) and recreation (game management, fisheries management).

Careful negotiation by the partner NGOs with farmers and landowners has balanced their needs with those of biodiversity and flood protection gains. The programme of works for an offset project is agreed with a third party (a local environmental NGO) and secured with the Council by a legal agreement through the statutory planning process. The projects are steered by a small group chaired by the Council, with developer and NGO representatives. Projects use bespoke geographic information systems (GIS) decision support tools including mapping, developed under a national land-use strategy pilot project (Scottish Government, 2016) to guide the work. Costings are based on agri-environment rates plus a management fee for administration of the project.

Working in partnership with the local authority planners, developers, local and national NGOs, and local land managers has worked well. This combined approach has helped to identify sites where habitat enhancement could deliver for biodiversity and enhance the habitat network within the wider landscape. The mechanism developed under the planning process has been robust and there has been an increasingly positive response to this from renewable energy developers.

Initial projects under the Scottish Borders biodiversity offsets programme included two black grouse projects (Central Southern Uplands and Lammermuirs), targeted in core areas for the species in the region and building upon an existing vehicles run by the Southern Uplands Partnership and Lammermuir Black Grouse group. These projects have together put more than 30 000 hectares under positive management for this bird. Through the Scottish Rural Development Programme, offsetting has attracted more than £3M in extra resources for habitat improvement and management. The habitat works also help meet the objectives of the Scottish biodiversity strategy (Scottish Executive, 2004), the Scottish Borders LBAP (2018), the Forestry Commission (2009) and the Council’s biodiversity duty under the Nature Conservation (Scotland) Act 2004.

Current projects are:

- Penmanshiel compensatory replanting scheme – creating 110 hectares of new woodland including native woodland, amenity woodland and commercial conifer and broadleaves to deliver multiple benefits.
- Langhope Rig Ale water wetlands – providing and improving wetlands in a catchment important for basin mires.
- Langhope Rig Upper Teviot riparian woodland scheme – delivering natural flood management benefits in catchments upstream of Hawick.

A further scheme (Quixwood windfarm) will develop breeding wader habitat in core areas within the region, known as the Borders Wader Initiative, and will be launched in spring 2018.

26.3 KEY BENEFITS AND SUCCESS FACTORS

The offset scheme illustrates a policy approach to conserving and improving biodiversity, based on a hierarchy of policy options. Developers must first try to avoid adverse impacts on habitats and species, for example by considering development sites that have no sensitive features. They must then seek to mitigate biodiversity impacts through, for example, the timing and method of construction. Where residual impacts on local biodiversity cannot be avoided then, as a last resort, these must be compensated for.

By working with local partners to develop an offset mechanism, the Council has ensured that, where compensation is the only option, appropriate habitat compensatory measures can be secured. When well planned and executed, compensation in the form of offsite biodiversity enhancement may be more

beneficial for the affected wildlife than seeking to maintain existing, isolated habitats and species on proposed development sites. The offset mechanism has also informed the Forestry Commission Scotland (2009) guidance.

Several lessons have been learned since the project approach started in 2009. Developing a mechanism that brings together a partnership of planners, developers and NGOs has been invaluable as has the specific formation of effective delivery partnerships that are able to work closely with the farming community. In addition, developing a set of documents and agreements to secure delivery has been important, such as the biodiversity guidance by the Scottish Border Council (2006). This has helped to mainstream biodiversity provision and offsets into the planning system.

The approach has exceeded initial habitat targets, however the ability to secure long-term habitat protection and management has been a challenge. More recent projects are focusing on this issue, for example the Penmanshiel project will secure woodland under 20 year contracts, and the local authority, and the Langhope Rig Ale water wetlands and Upper Teviot riparian woodlands will secure habitats under a 10-year agreement.

The next step for the authority will be to improve financial costings for compensation, potentially by using biodiversity metrics.

27 Living roof enhancement, Bolsover Street

Details

Organisation	Manhattan Loft Corporation, Ridgeford
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Project owner	Greengage Environmental Ltd, morgan.taylor@greengage-env.com

27.1 PROJECT SUMMARY

Proposals were sought to extend a roof terrace on the seventh floor of a residential development located near to Regent's Park in central London. This would have resulted in the loss of a small area of sedum roof. Local planning policy required development to preserve biodiversity, encouraging net gains for habitats and species of local, regional and national conservation importance, which in this instance included living roofs.

A strategy was devised which included proposed habitat improvement works for another section of sedum roof located on the sixth floor of the same building. This strategy aimed to compensate for the loss of the seventh floor sedum roof, and result in overall BNG. To quantify this, Defra's biodiversity metric (Defra, 2012) was applied alongside the BRE's BREEAM land use and ecology area weighted species calculator.



Figure 27.1 Augmented living roof at 50 Bolsover Street

Both sedum roofs supported relatively low floral diversity, comprising pre-grown sedum blankets on low nutrient roof substrate. The substrate depth beneath the sedum blanket on the sixth floor roof varied between 80 mm and 120 mm. Several wildflower and grass species had self-seeded, establishing, in principle, the potential for additional seeding and plug planting. Both roofs were lacking in habitat structure, or other features that could be considered of potential value for invertebrates, birds and bats.

The strategy included the following actions:

- Seeding and plug planting of 10 wildflower species that thrive on low nutrient living roofs and are of value for notable invertebrates.
- Placement of stone and sandy piles to add habitat structure for invertebrates such as solitary bees.
- Planting of:
 - new pollinator-friendly herbaceous raised beds on the sixth floor flat balcony.
 - an ivy visual screen to delineate the edge of the roof with the adjacent balcony.
- Provision of two 'invertebrate hotel' structures to provide added aesthetic benefit and potential habitat structure for invertebrates.

The strategy also defined a management and monitoring plan, which included a feedback mechanism to note and action any appropriate remedial works, ensuring the continued improved ecological functionality of the roof. This was previously lacking.

The BREEAM calculator accounted for new planting, however it did not provide a mechanism for factoring in the invertebrate enhancement features, and the general improved 'condition' at site. Some professional judgement had to be used to categorise the sedum roof habitats in terms of distinctiveness and quality. The calculation was made based on the following conditions:

- The living roof (as it exists) was considered of moderate quality (with sedum species seemingly growing well, but supporting poor floral diversity), with the proposed roof good quality. But an active management plan needed to be in place that addressed biodiversity actions.
- The living roof (as it exists and as proposed) was of high distinctiveness if judged as habitat category PI2 of JNCC (2010). Living roofs of this type are designed as an analogue of previously-developed land. This category presented a reasonable proxy, with no known alternative precedent given the infancy of this methodology at the time of the original report in 2014.

27.2 OUTCOMES

An initial planning application was submitted in 2014. Following several technical queries, consent was granted on appeal in January 2015. A pre-commencement condition requiring a biodiversity improvement and management plan was submitted to and approved by the LPA. Works to the sixth floor living roof were completed in January 2018.

A three-year monitoring regime has been instructed by the developer, with the roofs maintained in perpetuity.

The main outcome was to establish the use of the BREEAM and Defra calculators to demonstrate BNG relating to a GI asset in an urban planning scenario.

This project is an example of retrofitting biodiversity features within an existing building. The provision of visually-pleasing features (patterned stones and 'sculpture-like' invertebrate towers) was well received. The client was supportive of the strategy and appreciated the benefits that an ecosystems approach could have for the value of the site.

27.3 KEY BENEFITS AND SUCCESS FACTORS

It was important that the ecologist had an active role in liaising with the landscaping/living roof company, meaning nothing was lost in translation.

Initially, there was a lack of understanding from the local planning authority of the concepts relating to technical feasibility of the proposed works (eg relating to the loading implications and ability to plug/plant in a sedum blanket). This was addressed through clear communication, employing a multidisciplinary team (including landscape professionals, ecologists and engineers) and providing supporting evidence.

The lack of dedicated biodiversity planning officers within a local planning authority may also create issues when technical judgements are required.

Some presumptions had to be made with respect to quality and distinctiveness in the absence of any guidance relating the offsetting tool to GI or the urban environment.

The most important learning point is that it is possible to augment existing GI assets and retrofit ecological features to the built form as both a compensatory measure and to achieve calculable BNGs.

28 Enhancing biodiversity on large-scale solar farms

Details

Organisation Wychwood Biodiversity, Clarkson & Woods
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28.1 PROJECT SUMMARY

Wychwood Biodiversity has been working with several solar farm asset owners to develop biodiversity management plans, oversee habitat creation and maintenance, and to monitor biodiversity annually using standard methods. Monitoring includes botany, selected invertebrates and breeding birds.

The principal drivers for this work are that some asset owners are keen to add value to renewable energy projects and contribute to biodiversity and ecosystem services, partly for their own PR and partly for sector leadership. There are no specific corporate BNG goals set, but owners have expressed a wish to improve biodiversity.

Avoidance of impacts to biodiversity was dealt with during site selection and the planning process. Minimisation and compensation efforts are dealt with partly through site design and partly through habitat improvement. While not termed offsetting, the habitat creation works undertaken post-construction lead to an increase in biodiversity as compared to baseline conditions (usually an arable field).

The main activities included habitat creation through sowing species rich grasslands, planting hedges and scrub, and creating nesting and roosting habitats, including hibernacula, bird and bat boxes and bug hotels.

Annual assessment measures include a quadrat survey of botany and a transect survey of invertebrates in mid-summer, and two breeding bird surveys in spring/early summer following the British Trust for Ornithology methodology.

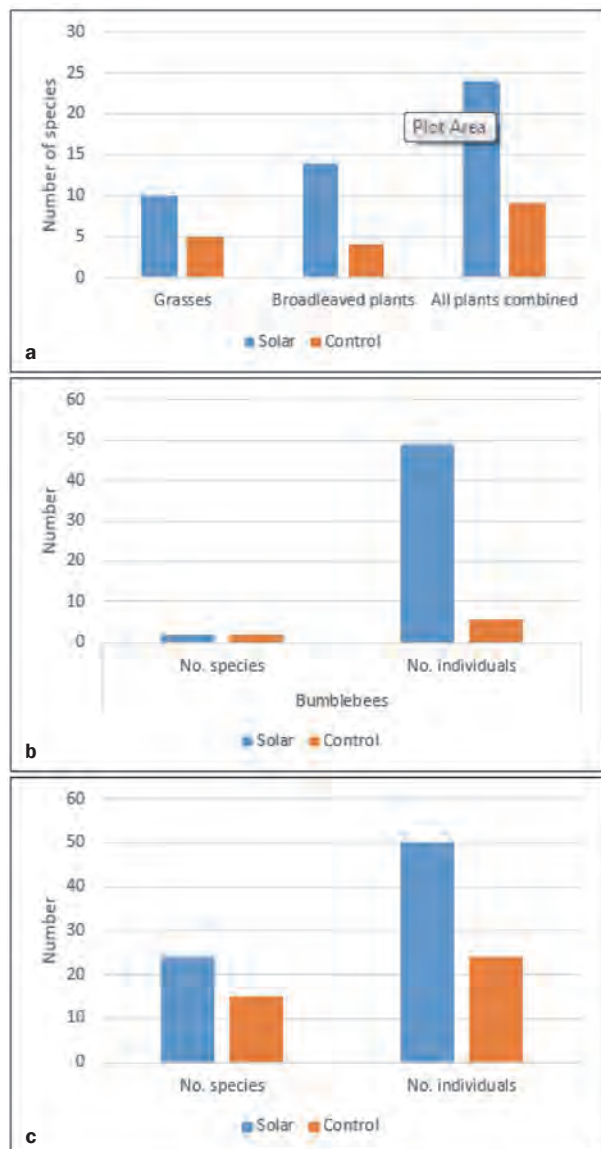


Figure 28.1 Results of solar farm surveys comparing solar farms with control plots with botany (a) bumblebees (b) and breeding birds (c) (from Montag et al, 2016)

In 2015, Wychwood Biodiversity and Clarkson & Woods undertook research on biodiversity at 11 solar farms across the UK. The same methodology as above was used, but in addition to surveying the solar farm, a control plot representing the land use before the solar farm being established was selected on neighbouring land.

Figure 28.1 shows results from a single solar farm included in this study, which had been re-sown with a wild flower meadow, whereby the number of:

- plant species was significantly higher in the solar farm than the control (an arable field)
- bumblebee species was similar between solar farm and control but the abundance on the solar farm was significantly higher
- species of breeding birds was marginally higher in the solar farm and abundance was greater.

The process of habitat creation on a solar farm is straightforward, with many approaches being borrowed from agri-environment schemes. The problems stem mainly from:

- justifying the multiple benefits of biodiversity to the asset owner, with many not expressed financially
- the weather during seeding operations
- controlling injurious weeds on ex-arable land
- only being able to use a simple monitoring programme.



Figure 28.2 Solar farm with recent habitat restoration (courtesy G Parker)

28.2 OUTCOMES

After four to five years the most successful sites are starting to demonstrate increases in the key biodiversity indicators as compared to baseline. This includes increases in the diversity and abundance of common native flowering plants, bumblebees and breeding birds.

29 Further case studies

These case studies have been produced or adapted specifically for this compilation. However, the authors and PSG have identified several further published case studies that illustrate the practices set out, including:

- Atkins and Redrow Homes *Working towards biodiversity gain*:
<http://www.atkinsglobal.com/en-GB/projects/working-towards-biodiversity-gain>
- Business and Biodiversity Offsets Programme, *Non-BBOP Compensatory conservation case studies – 2009*:
http://www.forest-trends.org/documents/files/doc_3123.pdf
- The Environment Bank (multiple case studies): **<http://www.environmentbank.com/case-studies.php>**
- Natural England *Lorton Valley Nature Park*: **publications.naturalengland.org.uk/file/5267861**
- Natural England *Mayesbrook Park*: **publications.naturalengland.org.uk/file/12352252**
- Natural England *Victoria business improvement district*:
publications.naturalengland.org.uk/publication/11844873

References

- BARRATT HOMES (2018) *Giving nature a home*, Barratt Homes, UK
<https://www.barratthomes.co.uk/New-is/Green/Editorial-block---Giving-nature-a-home>
- BREEAM *Land use and ecology calculator*:
https://www.breeam.com/BREEAMUK2014SchemeDocument/#11_landuse/landuse.htm%3FTocPath%3D11.0%2520Land%2520Use%2520and%2520Ecology%7C_____0
- CHEFFINGS, C M and FARRELL, L (eds) (2005) Dines, T D, Jones, R A, Leach, S J, McKean, D R, Pearman, D A, Preston, C D, Rumsey, F J, Taylor, I (2005) *The Vascular Plant Red Data List for Great Britain. Species Status 7*, Joint Nature Conservation Committee, Peterborough, UK
http://jncc.defra.gov.uk/pdf/pub05_speciesstatusvpredlist3_web.pdf
- CLG (2012) National Planning Policy Framework, Department for Communities and Local Government, London, UK (ISBN: 978-1-40983-413-7)
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf
- CROFT, S (2016) *National cirl bunting survey 2016*, Royal Society for the Protection of Birds and Devon Birds, UK
https://www.devonbirds.org/news/harrier/the_harrier?blogMonth=7&blogYear=2016&blogEntry=11407
- CSWAPO (2018) *Warwickshire, Coventry & Solihull sub-regional green infrastructure strategy*, Coventry, Solihull and Warwickshire Association of Planning Officers, Warwickshire County Council
<https://apps.warwickshire.gov.uk/api/documents/WCCC-863-513>
- DEFRA (2013) *Biodiversity offsetting in England. green paper*, Department for Environment Food and Rural Affairs, London, UK
https://consult.defra.gov.uk/biodiversity/biodiversity_offsetting/supporting_documents/20130903Biodiversity%20offsetting%20green%20paper.pdf
- ENVIRONMENT AGENCY (2013) *Medmerry managed realignment scheme*, Environment Agency, Bristol, UK
https://restorerivers.eu/wiki/index.php?title=Case_study%3AMedmerry_Managed_Realignment_Scheme
- FORESTY COMMISSION (2009) *The Scottish Government's policy on control of woodland removal*, Forestry Commission Scotland, Edinburgh (ISBN: 978-0-85538-781-5)
[https://www.forestry.gov.uk/PDF/fcfc125.pdf/\\$FILE/fcfc125.pdf](https://www.forestry.gov.uk/PDF/fcfc125.pdf/$FILE/fcfc125.pdf)
- GLA (2012) *Green infrastructure and open environments: the all London green grid*, Mayor of London, Greater London Authority. London, UK (ISBN: 978-1-84781-505-7)
https://www.london.gov.uk/sites/default/files/algg_spg_mar2012.pdf
- GLA (2014) *Environment strategy*, Mayor of London, Greater London Authority. London, UK
https://www.london.gov.uk/sites/default/files/london_environment_strategy-_draft_for_public_consultation.pdf
- GLA (2018) *Transport strategy*, Greater London Authority. London, UK
<https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf>
- HM GOVERNMENT (2018) *A green future: our 25 year plan to improve the environment*, Department for the Environment, Food and Rural Affairs, London, UK
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf
- JNCC (2010) *UK Biodiversity Action Plan priority habitat descriptions*, Joint Nature Conservation Committee, Peterborough, UK
http://jncc.defra.gov.uk/pdf/UKBAP_BAPHabitats-40-OMH-2010.pdf
- MILLER, J and JENNINGS, S (2014) *South Devon biodiversity offsetting guidance*, Natural Devon, UK
<https://www.naturaldevon.org.uk/wp-content/uploads/2013/04/South-Devon-Biodiversity-Offsetting-Guidance-October-2014.pdf>
- MOILANEN, A and NIEMINEN, M (2002) "Simple connectivity measures in spatial ecology" *Ecology*, vol 83, 4, JSTOR and Ecological Society of America, Washington DC, USA

MONTAG, H, PARKER, G and CLARKSON, T (2015) *The effects of solar farms on local biodiversity: a comparative study*, Clarkson and Woods and Wychwood Biodiversity, Somerset and Devon, UK (ISBN: 978-1-52620-223-9)
<https://www.solar-trade.org.uk/wp-content/uploads/2016/04/The-effects-of-solar-farms-on-local-biodiversity-study.pdf>

NATURAL ENGLAND (2014) *Protected species: how to review planning applications*, Natural England, London, UK
<https://www.gov.uk/guidance/protected-species-how-to-review-planning-applications#standing-advice-for-protected-species>

NETWORK RAIL (2017) *Biodiversity calculator, user guide version 2*, Network Rail, London, UK
https://safety.networkrail.co.uk/wp-content/uploads/2017/12/NR-Biodiversity-Calculator-User-Guide_V2.pdf

SCOTTISH BORDER COUNCIL (2006) *Supplementary planning guidance for biodiversity*, Planning and Economic Development, Scottish Border Council, Melrose, Scotland
<https://www.scotborders.gov.uk/downloads/file/931/biodiversity>

SCOTTISH BORDER COUNCIL (2018) *Local biodiversity action plan. Overview and first steps*, Scottish Border Council, Melrose, Scotland
https://www.scotborders.gov.uk/downloads/file/928/local_biodiversity_action_plan

SCOTTISH EXECUTIVE (2004) *Scotland's biodiversity. It's in your hands*, Scottish Executive, Scotland (ISBN: 0-75594-120-9)
<http://www.gov.scot/Resource/Doc/25954/0014583.pdf>

SCOTTISH GOVERNMENT (2016) *Regional pilot projects*, Scottish Government, Edinburgh, Scotland
<http://www.gov.scot/Topics/Environment/Countryside/Landusestrategy/regional>

TfL (2014) *Corporate environment framework*, Mayor of London and Transport for London, UK
http://bailey.persona-pi.com/Public-Inquiries/Barking%20Riverside/B-Core%20Documents/Category%20D%20National,%20London%20and%20Local%20Policy%20and%20Guidanc%20Documents/D23%20-%20tfl_corporate_environment_framework.pdf

TfL (2017) *Healthy streets for London*, Transport for London, UK
<http://content.tfl.gov.uk/healthy-streets-for-london.pdf>

UKGBC (2015) *Demystifying green infrastructure*, UK Green Building Council, London, UK
<https://www.ukgbc.org/wp-content/uploads/2017/09/Demystifying-Green-Infrastructure-report-FINAL.pdf>

Standards

BS EN ISO 14001:2015 *Environmental management systems. Requirements with guidance for use*

Statutes

Acts

Nature Conservation (Scotland) Act 2004 (asp 6)

Natural Environment and Rural Communities (NERC) Act 2006 (c.16)

Regulations

Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (no.571)